Chemical Engineering

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Scaleup of Equipment for Solids Processing p. 155

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New Opportunities for Profits ..in Liquid-Solids Separation

Eimco's research into the problems of liquid-solids separation has resulted in savings of thousands of dollars every year for many chemical companies.

Just a few years ago, for example, it was not considered possible to filter high temperature or high vapor pressure slurries, or slurries having volatile, flammable, toxic, or viscous characteristics. Today, these difficult materials are being filtered continuously and economically in modern pressure filters of the type developed by Eimco.

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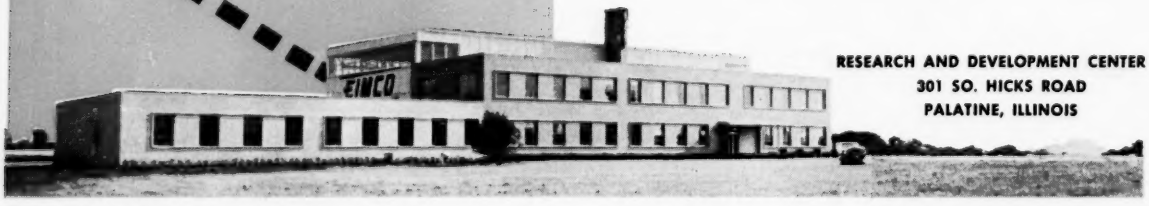
In its modern scientific facility at Palatine, Illinois, Eimco research engineers are constantly seeking new answers to liquid-solids separation problems. In the field, Eimco engineers work with your engineers, bring the results of research to your problems, with profitable results for you. The Eimco representative in your area will gladly give you more details.



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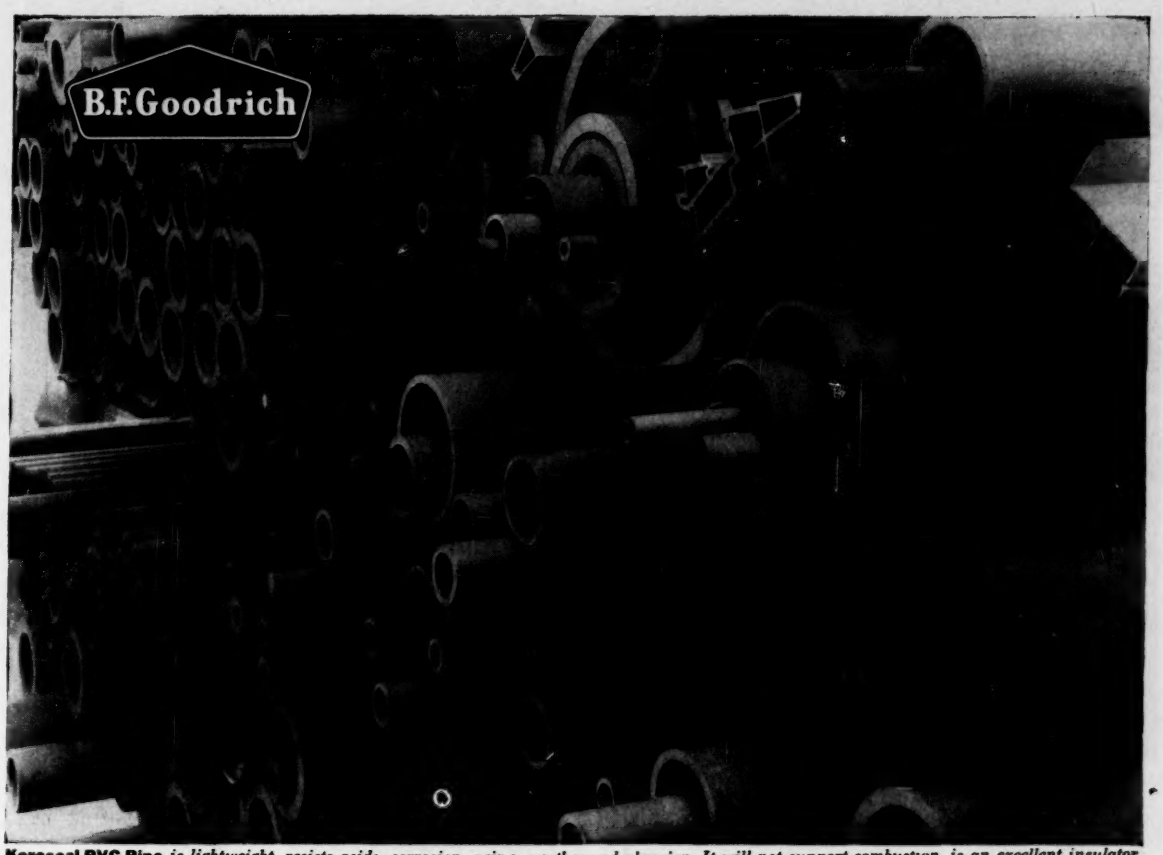

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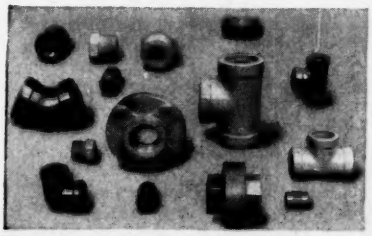
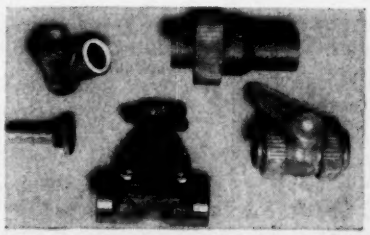
The more severe the service conditions, the more apparent are the superior properties and quality of rigid Koroseal PVC pipe, fittings, valves and sheet. Koroseal PVC is delivering long, trouble-free service in a multitude of industrial applications where corrosion, chemicals, high pressures and physical abuse ruined other types of pipe in a hurry. And savings are substantial—on original cost, installation costs, reduced maintenance and longer life. Investigate the many advantages of Koroseal PVC pipe now. For details, etc., write Dept. CE-9. *B. F. Goodrich Industrial Products Company, Marietta, Ohio.*



Koroseal PVC Fittings *can be joined to Koroseal pipe by solvent-cementing, heat welding, flanging or threading. Recessed threads protect against damage, eliminate cross threading. There's a size and type for every need.*



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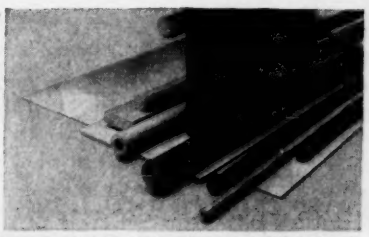

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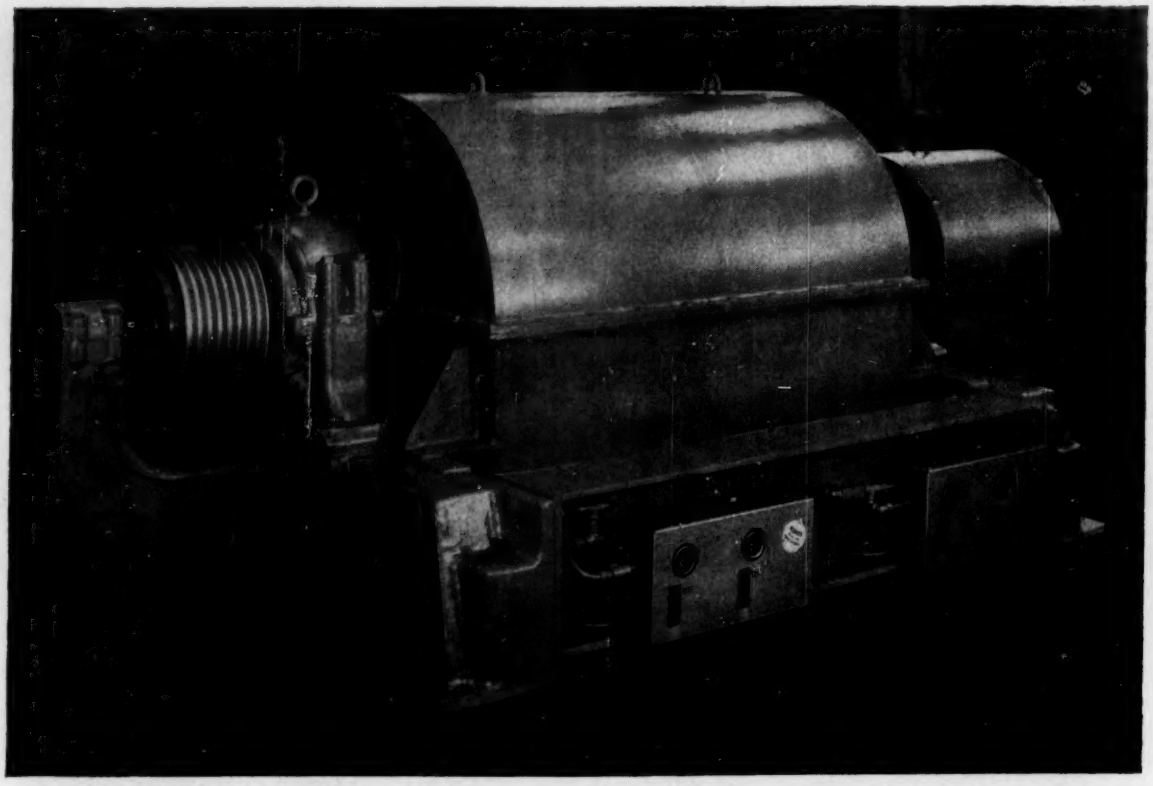

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Frankly, it would be difficult to tell by glancing at the exterior of a Bird Continuous Solid Bowl Centrifugal whether it was built *this* year or a quarter century ago. Old or new, you can always tell a Bird by its clean, compact, uncluttered look.

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Sept. 21, 1959 **Chemical Engineering** Vol. 66, No. 19

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"The tremendous growth of the processing industry has brought with it some corresponding problems. There is the constant need for higher efficiencies, greater capacities, higher speeds and closer controls.

"Here at De Laval, we have a three part program to help processors overcome these problems: an outstanding engineering staff, the most complete pilot plant in the country, and a full line of proven process equipment.

"In some cases, it simply means replacing more traditional methods with up-to-date equipment. One of our customers replaced a batch settler 26′ deep with a diameter of 16′ with two new high capacity centrifuges. Manpower requirements were cut in half; the yields and quality were far higher; and total processing time was considerably reduced. Perhaps most important, the new method is *continuous*.

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For further information, write to De Laval.

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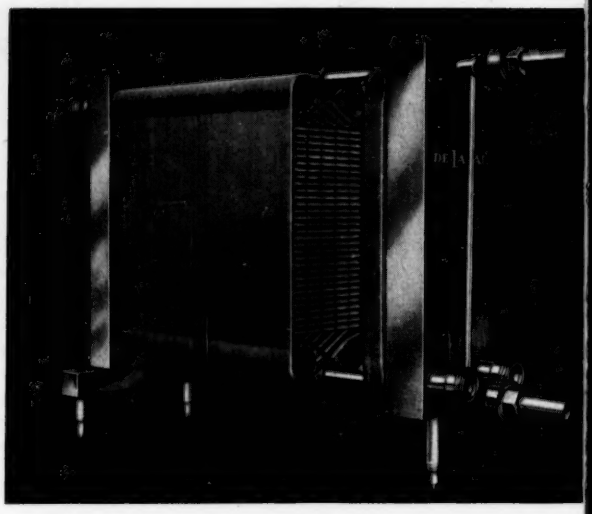
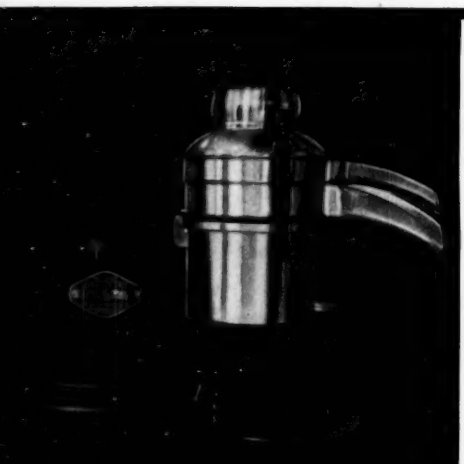


THREE SOLVED WITH



Little centrifuge does a big job for processor of ball-point inks

Problem: To remove all oversized particles and agglomerates in ball-point inks. Otherwise, the ink would plug in ball-point pens.

Solution: The De Laval Gyro-Tester. Only slightly more than 18″ high, this unit thoroughly clarifies up to 25 gallons of ball-point ink per hour.

A big advantage in this installation, the small bowl size minimizes bowl cleaning time between runs of different colored inks.

Although the unit is small (approximately 10″ wide by 15″ long by 18″ high), it develops centrifugal force of 10,000 g's. That's enough to clarify the inks of particles down to one micron in size.

De Laval Gyro-Testers are used more commonly for pilot scale work in processing plants to determine the nature of full scale processing operations. The units cost well under $1000.00, and have more than proved their worth in all phases of the processing industry.

If your processing operations could benefit from pilot work on your own site or from sample runs on new materials, why not write for more descriptive information about the De Laval Gyro-Tester? There's no obligation, of course.

Antibiotic processor saves six million BTU's in every hour of operation

Problem: How to heat 60,000 lbs. per hour of antibiotic broth from 72°F. to 170°F. under completely sanitary conditions and make the most efficient use of the heating medium.

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No other type of heating or heat transfer unit can touch the efficiency of the De Laval Plate Heat Exchanger. This processor alone saves better than six million BTU's for every hour the unit is in operation.

Besides the tremendous problems inherent in cleaning a Shell & Tube Exchanger, a competitive quotation in this same installation indicated it would cost nearly twice as much. If it had been chosen, the processor would have had to erect the exchanger outside of his building and at considerably higher installation expense. The Plate Heat Exchanger is a compact piece of equipment. It can be installed inside your plant, and takes a minimum of floor space.

Whatever your heating or cooling requirements, you'll probably find that there is a plate heat exchanger readily available to meet your specific needs. Temperatures can be controlled to within 1°F. and held exactly for hours on end. If you'd like more information, just drop us a line about your process on your letterhead. No obligation, of course.

PROCESSING PROBLEMS... DE LAVAL PROCESS EQUIPMENT

CENTRIFUGES • PLATE HEAT EXCHANGERS • VIBRATING SCREENS • COMPLETE PROCESSES

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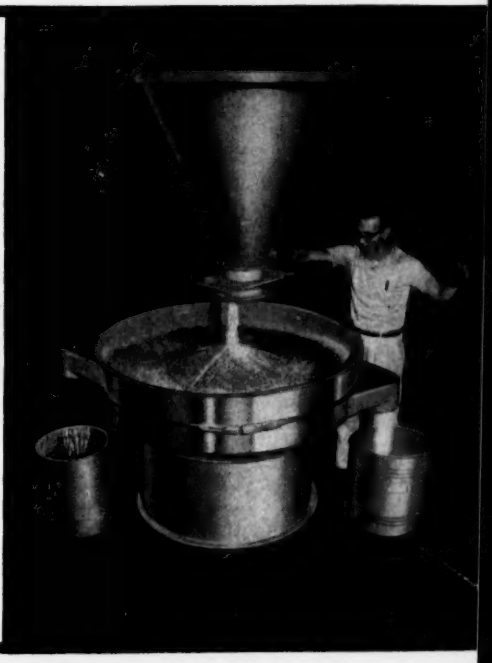
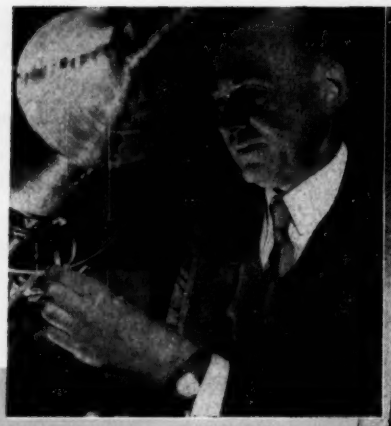
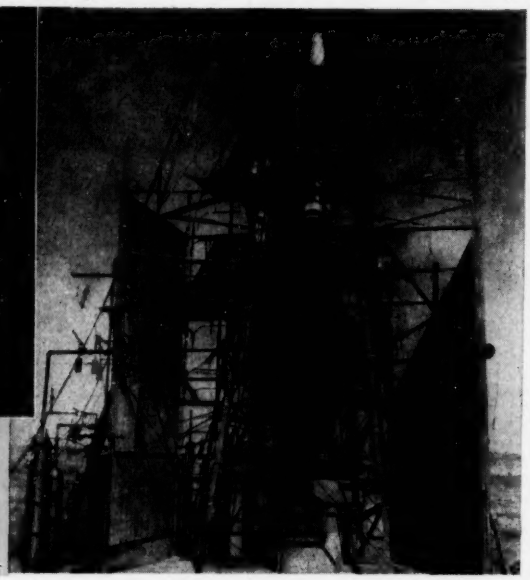
The action is not affected by a varying feed rate; efficiency is constant whether the machine is set for gentle or turbulent action.

The Syncro-Matic is available in carbon or stainless steel, with from one to three decks, and a full range of screen meshes and materials. Operation is exceptionally quiet.

If you would like more information about this versatile new screen separator, just drop us a line on your letterhead. There is no obligation of course.







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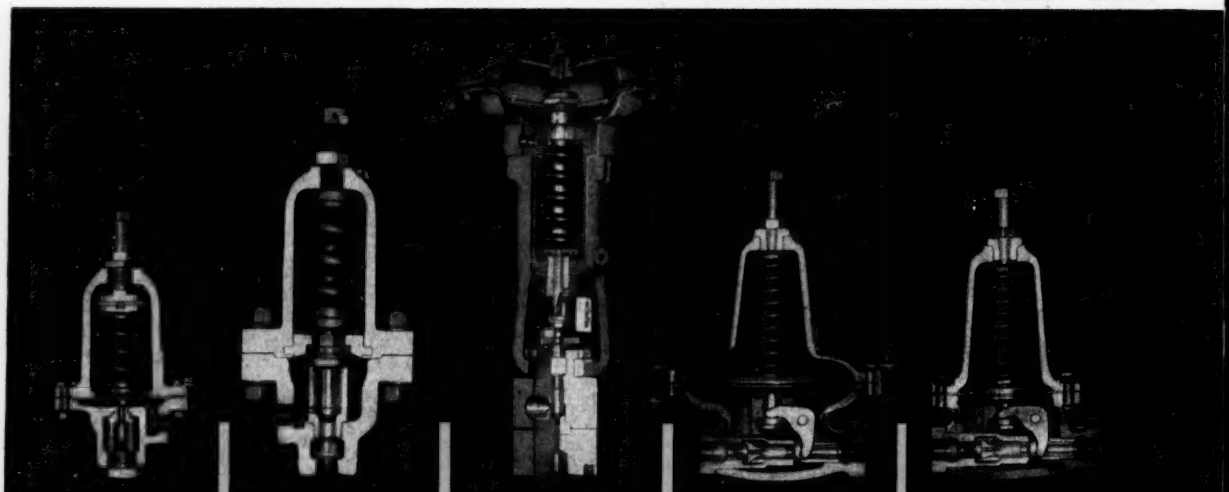

Type HP Reducing and Regulating Valve
¼" — 1½"
Inlet Max. 3000#;
Reduced Max. 750#
Material — Bronze, Steel
Trim—Stainless Steel; Glass Filled Teflon Balanced Unit; Either Composition or Metal Seat

Type 2275 Relief Valve
½" — 2"
Max. Relief Press. 3200 lbs.
Material — Bronze, Steel
Trim — Stainless Steel Metal Seat

Type 505 Motor Valve For High Pressure Drop
½" — ¾" — 1"
Max. Initial Press. 10,000#
Material — Stainless Steel
Trim — 440 Hardened Seat, Plug. Throttling, On-Off; Micro Spline; Cv 0.008 to 3.2

Type 1000 LP Reducing and Regulating Valve
¼" — 2"
Max. Inlet 400#
Max. Reg. Press. 30 lbs.
Material — Iron, Bronze, Steel
Trim — Bronze, Stainless Steel, Neoprene or Teflon

Type 1000 HP Reducing and Regulating Valve
¼" — 2"
Max. Inlet 400#
Max. Press. 200#
Material — Iron, Bronze, Steel
Trim — Bronze, Stainless Steel, Neoprene or Teflon

Dr. Robert H. Goddard, the inventor of the modern liquid propellant rocket, found that reliable, positive acting control valves were a vital necessity for harnessing heavy gas pressures while fueling his early liquid propellant rockets. At that time, because of the unusual nature of his work, Dr. Goddard was required to make his own valves. At left is the launching site for Dr. Goddard's rocket experiments from 1930 to 1942 near Roswell, New Mexico.

Today, several types of A. W. Cash Control Valves are at work at missile launching sites carrying on the high standard of reliability initiated by Dr. Goddard.

Photos Courtesy of Mrs. Robert H. Goddard

Must Be Reliable

A. W. Cash valves are well known for their quality and low cost maintenance. When in the line they are easily accessible with all parts interchangeable. The methods of tooling and production control used in their manufacture guarantee uniformity of tolerances and dimensions of all valve components. Make A. W. Cash Co. your *one-stop source* for reliable control valves for gases, liquids and steam.

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Body and trim materials used are for pressures up to 2500# and for temperatures from −425°F to +1600°F.

Series 6000 Valves are designed for converting to reverse seat action without removing valve body from the line.

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A. W. CASH CO.

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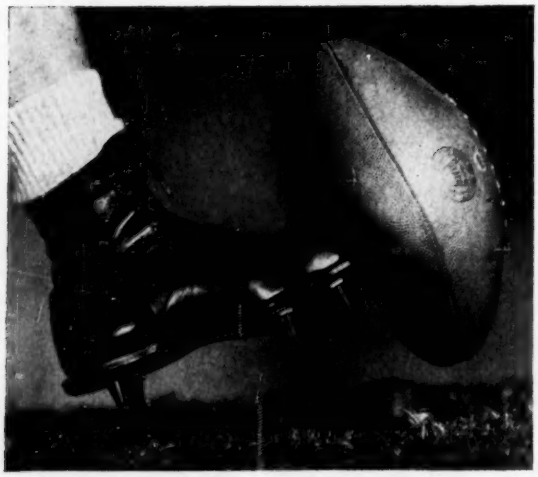
The lady has an eye for color. She looks for color — buys color — in many things, including paints. And PURECAL in paint formulations makes colors clearer, brighter, better. PURECAL improves flow, was the first extender to be found compatible with the new type latices used in many of today's improved paints. PURECAL also improves hiding by aiding dispersion of titanium pigments, and bodying action of particles keeps coarser pigments from settling out.



Some kick . . . but the "snap" in the rubber *helps* get the ball off the ground. An ultrafine grade of coated PURECAL increases modulus and resilience in rubber.

Indispensable! A girl is lost without her lipstick. PURECAL contributes to the color and quality of lipstick . . . and many other cosmetic preparations.

ONE OF A SERIES

WYANDOTTE PURECAL®

makes countless things better because it's so pure, so white, so uniform

On the highway, a bold streak of color keeps you informed of safe driving restrictions. In your home, colors express your personality and add to your pleasure. Color in paint is a mighty important part of our lives.

That's why Wyandotte PURECAL is proving such a boon to the paint industry. You see, Wyandotte's double refining—a unique reaction process—yields precipitated calcium carbonate that excels as a pigment extender. Reasons: It's the whitest material in its class . . . and it exceeds U.S.P. purity standards. These advantages work to make countless things better, from wire insulation to insecticide dusts.

PURECAL particles are consistently cubical in shape, and of accurate size . . . important advantages if your formulation calls for calcium carbonate. Samples and data are available for the writing. Because PURECAL comes in various grades for specific applications, please include details on your requirements. *Wyandotte Chemicals Corporation, Department 2-N, Wyandotte, Michigan. Offices in principal cities.*

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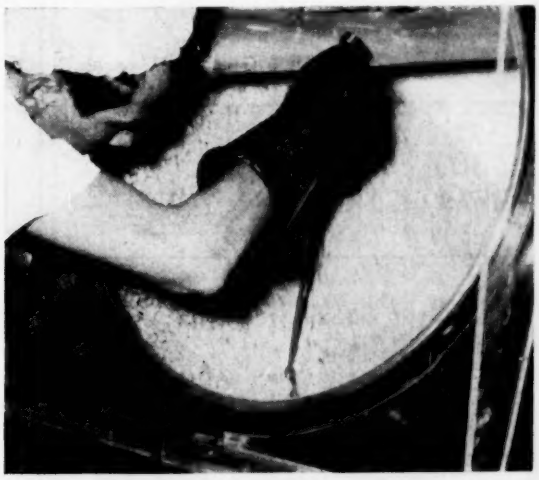
PACING PROGRESS WITH CREATIVE CHEMISTRY

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA • CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE • MURIATIC ACID • HYDROGEN • DRY ICE • GLYCOLS
SYNTHETIC DETERGENTS (anionic and nonionic) • SODIUM CMC • ETHYLENE OXIDE • ETHYLENE DICHLORIDE • POLYETHYLENE GLYCOL • PROPYLENE OXIDE
PROPYLENE DICHLORIDE • POLYPROPYLENE GLYCOL • DICHLORODIMETHYLHYDANTOIN • CHLORINATED SOLVENTS • OTHER ORGANIC AND INORGANIC CHEMICALS

PURECAL's technical qualities stand out in use as an enamel-color extender in ceramics production. Its purity and whiteness keep colors clear and true.



PURECAL is used without further purification as a coating for tablets and pills. It is also a neutralizing agent in the preparation of antibiotics.

THE UNVARNISHED FACTS

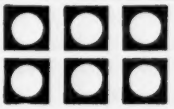
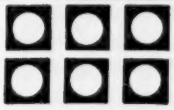
about engine compressors in the 375 to 950 hp range

FEATURE	WORTHINGTON SLHC	MFR. A	MFR. B	MFR. C
DESIGNED FOR TURBOCHARGING	Yes	No	No	No
SELF-SUSTAINED TURBOCHARGING	YES	NO	NO	NO
FUEL CONSUMPTION	7,000 BTU/BHP HR	9,000 BTU's	8,600 BTU's	8,500 BTU's
CYCLE	4	2	2	4
CYLINDER ARRANGEMENT	Inline	Inline	Vee	Vee
RPM	450	600	450	400
YEAR ENGINE WAS DESIGNED	1955	Before 1950	Before 1940	Before 1940
NUMBER OF DESIGNS TO COVER RANGE	1	2	2	2
LARGEST UNIT FOR SKID MOUNTING	950 HP	660 HP	1100 HP	660 HP

On these two pages you'll find a comparison of all the significant facts about gas engine compressors in the 375 to 950 horsepower range. We think you'll have to agree that Worthington's SLHC unit is the outstanding performer in its size range. Not only does it have 18% better fuel economy than the next nearest engine, but it also features self-sustained turbocharging, removable cylinder liners with cast-in water jacket, interchangeable power and compressor rods, and many other important engineering advances.

For complete details on the new SLHC engine compressor get in touch with your nearest Worthington district office. Or write to Worthington Corporation, Section 43-4, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantfold, Ont.

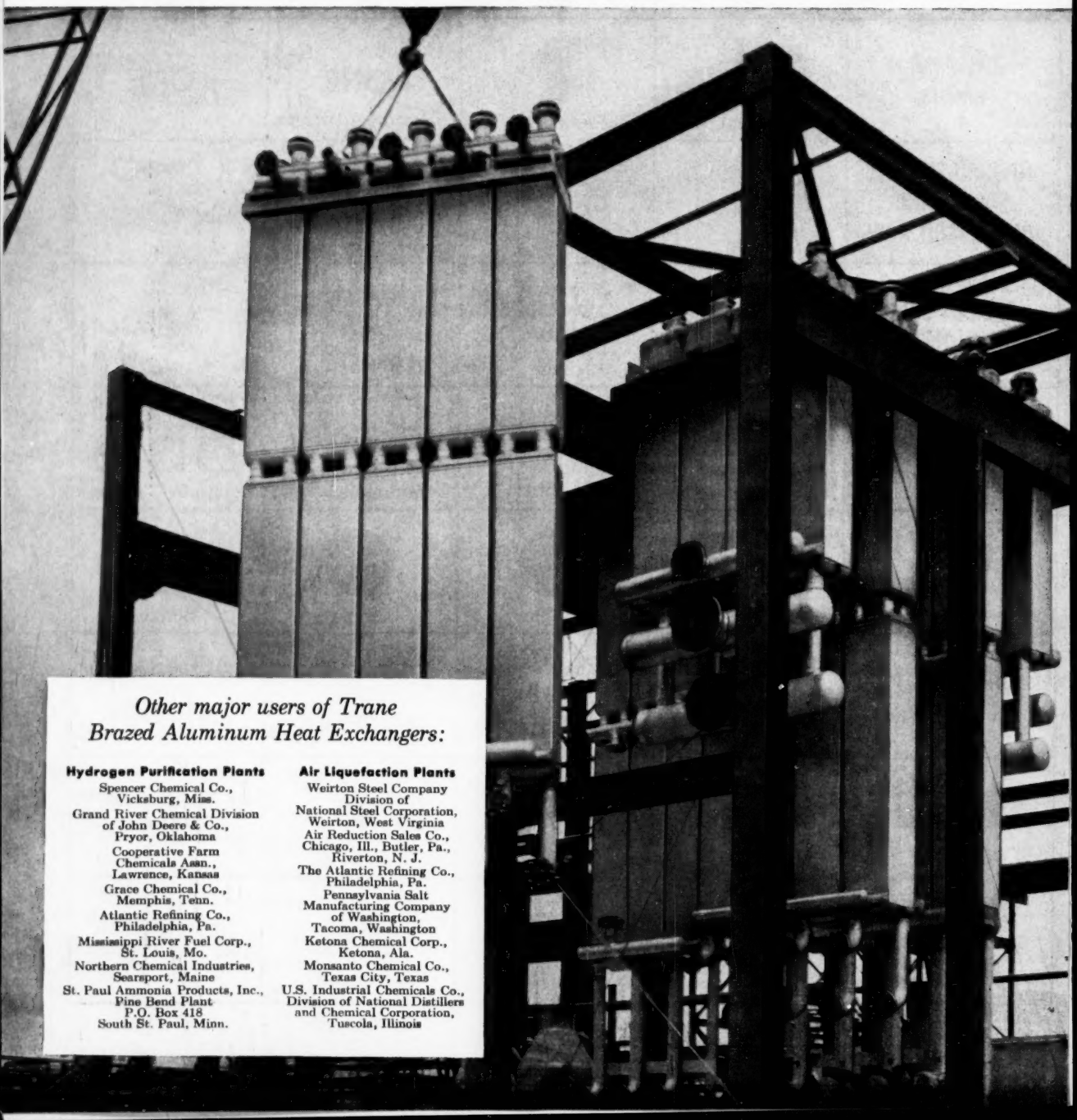
WORTHINGTON

FEATURE	WORTHINGTON SLHC	MFR. A	MFR. B	MFR. C
MOUNT CYLINDERS ON BOTH SIDES	Yes	No	No	No
CYLINDER LINERS	Removable	Removable	NONE	NONE
INTERCHANGEABLE POWER AND COMPRESSOR RODS	Yes	Yes	No	No
SIDE BY SIDE CONNECTING RODS	Yes	Yes	No	No
FRAME CONSTRUCTION	En-bloc	En-bloc	 Separate Cylinders	 Separate Cylinders
IGNITION	Twin	Single	Single	Single
RUNNING GEAR LUBRICATION	MANIFOLD CAST IN BASE	SEPARATE PIPE MANIFOLD	SEPARATE PIPE MANIFOLD	SEPARATE PIPE MANIFOLD
GASKET-FREE CYLINDER HEAD SEATS	YES	NO	NO	NO
RUNNING GEAR EASILY ACCESSIBLE	YES	NO	NO	NO

Rohm and Haas reports:

Close temperature approaches, Trane Brazed Aluminum

Sixty cores of TRANE Brazed Aluminum Heat Exchange surface are used in the production of oxygen at this Rohm and Haas plant. Installation was facilitated by the compact, rugged construction that cuts space and construction costs . . . packs up to 500 sq. ft. of heat transfer surface into one cubic foot. These reversing exchangers were installed by AIR LIQUIDE.



Other major users of Trane Brazed Aluminum Heat Exchangers:

Hydrogen Purification Plants

Spencer Chemical Co., Vicksburg, Miss.

Grand River Chemical Division of John Deere & Co., Pryor, Oklahoma

Cooperative Farm Chemicals Assn., Lawrence, Kansas

Grace Chemical Co., Memphis, Tenn.

Atlantic Refining Co., Philadelphia, Pa.

Mississippi River Fuel Corp., St. Louis, Mo.

Northern Chemical Industries, Searsport, Maine

St. Paul Ammonia Products, Inc., Pine Bend Plant P.O. Box 418 South St. Paul, Minn.

Air Liquefaction Plants

Weirton Steel Company Division of National Steel Corporation, Weirton, West Virginia

Air Reduction Sales Co., Chicago, Ill., Butler, Pa., Riverton, N. J.

The Atlantic Refining Co., Philadelphia, Pa.

Pennsylvania Salt Manufacturing Company of Washington, Tacoma, Washington

Ketona Chemical Corp., Ketona, Ala.

Monsanto Chemical Co., Texas City, Texas

U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation, Tuscola, Illinois

high oxygen purity, using Heat Exchangers

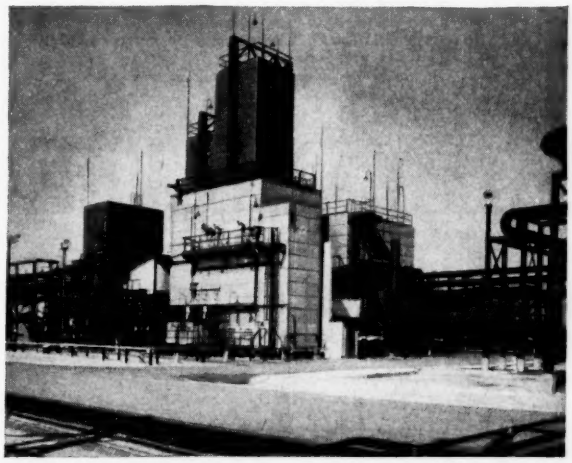
Lightweight, compact exchangers cut installation costs . . . assure trouble-free operation . . . handle up to 6 fluids easily

This Rohm and Haas plant in Pasadena, Texas, designed and constructed by AIR LIQUIDE, produces oxygen of high purity—well above specifications at the design rate—with TRANE Brazed Aluminum Heat Exchangers. After a full year of operation, Rohm and Haas reports temperature approaches as close as 2° F . . . operating temperatures as low as -291° F. And the plant started operation exactly on schedule—initial start up was accomplished within 12 hours.

This lightweight, compact heat exchange surface is being used in more and more installations where superior performance is essential—at over-all low cost. And TRANE Brazed Aluminum Heat Exchangers reduce erection and space costs, too, because a typical TRANE cold box installation requires only *half as much space* as one using conventional heat transfer equipment!

So for reduced refrigeration costs, close temperature approaches and trouble-free operation, design with TRANE Brazed Aluminum Heat Exchangers! Thirty years of specialized heat transfer experience is at your service.

WANT MORE FACTS? Ask your nearby TRANE Sales Office for complete data and application histories. Or write TRANE, La Crosse, Wisconsin.



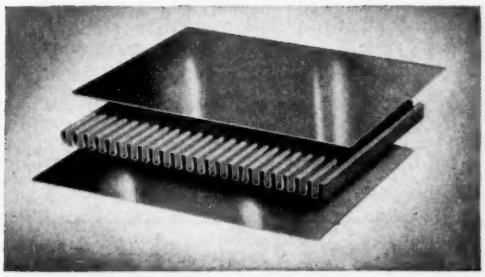
Over-all view of plant. TRANE Brazed Aluminum Heat Exchangers are used in the air plant, CO plant and in the nitrogen scrubbing unit. Plants are designed to operate down to -300° F. with pressures up to 450 psig. Installation in the CO plant features 6-stream operation. The oxygen plant is designed to produce over 300 tons per day.

For any air condition, turn to

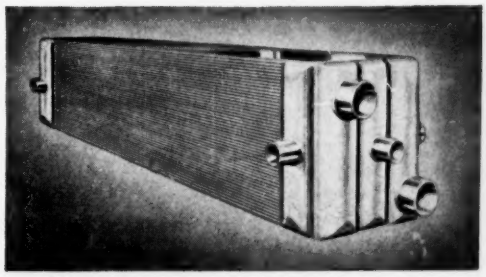
TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 100 U. S. AND 19 CANADIAN OFFICES



Lightweight, compact! TRANE Brazed Aluminum consists of corrugated aluminum sheets brazed together to form a stack of layers which provide individual passages for the flow of liquids or gases. Provides up to *nine times* the surface per square foot of shell-and-tube exchangers!



Headered for 5-stream operation, this TRANE Brazed Aluminum Heat Exchanger can handle as many as five fluids simultaneously. Units are available for either cross-flow or counter-flow operation. Surface can be fabricated in a wide variety of shapes and sizes to meet all types of requirements.

What have these "warriors' shields" got to do with better product performance?

Among the hundreds of different types of particles found in Celite diatomaceous earth are these "warriors' shields." Shown here magnified hundreds of times, are, from left to right, *Navicula splendida*, *Raphoneis amphiceros* and *Navicula lyra*.

They're particles of CELITE that adds strength-

Celite's unique diatomite structure is shown in this photomicrograph. The infinite variety of particle shapes and sizes gives Celite its exceptional performance characteristics in a wide range of process applications.

Johns-Manville CELITE

Helps polish-cleaners soak up dirt. Celite's highly porous diatomite structure soaks up and retains dirt and grease . . . provides easier "wipe-off" of polish-cleaners. This same structure gives these products a mild, non-scratching abrasive action.

Adds strength to molded plastics. The harder grades of Celite impart high impact strength to many plastic products. Celite fillers also provide a more attractive surface finish and greater resistance to heat and moisture.

Controls gloss in paints. When included in paint formulations, irregular Celite particles protrude through the surface, diffusing light and providing a highly desirable flat appearance. Celite's high oil absorption also provides viscosity control for the finishes industry.

-the diatomite mineral filler soaks up dirt–controls gloss

THE structure of the individual diatom particle is the key to the success achieved by Celite* diatomite in so many process applications.

It requires 40 million whole or fragmentary particles to form a cubic inch of crude Celite. Consequently, even when added in small proportions, their properties are greatly magnified and widely dispersed throughout a formulation.

Relatively hard and irregularly shaped, particle contact is mainly limited to protruding outer points. Therefore, Celite won't pack down and has an extremely low apparent bulk density of 10 lb/cu ft. This explains Celite's high bulking action, excellent suspendability, and large particle surface area.

This same limited particle contact means that 93% of a given volume of Celite is composed of air pockets or voids. And, since the particles themselves are porous and cellular in structure, Celite can absorb more than twice its weight of liquid before reaching its limit.

Celite is produced from the world's purest source of commercially available diatomaceous silica at Lompoc, California. Celite comes in a wide range of grades . . . each carefully controlled for complete uniformity.

Ask your nearest J-M Celite engineer to tell you how Celite can help solve your formulation problems.

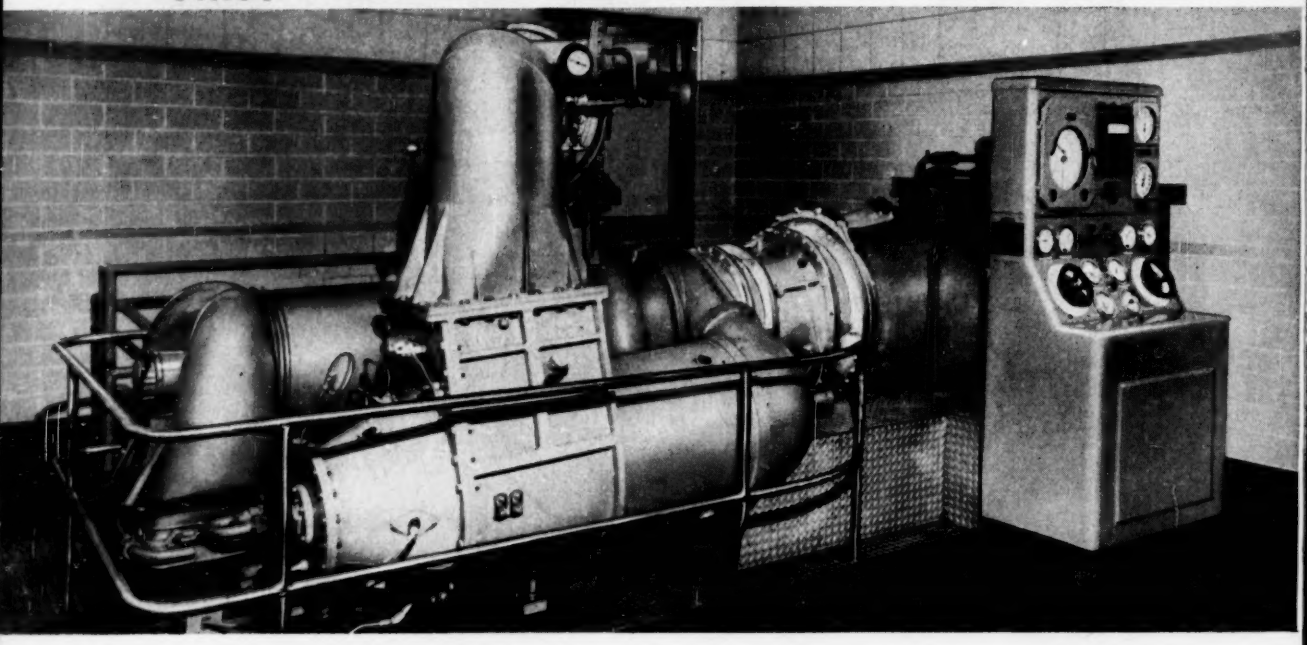
He's backed by Johns-Manville's extensive research facilities and years of practical diatomite experience. Call him today or write Johns-Manville, Box 14, New York 16, New York. In Canada, write Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

Industry's most versatile MINERAL FILLERS

JOHNS-MANVILLE JM PRODUCTS

FIRST **IN PRODUCTS PIPELINING** — Up to 100,000 b/d are moved by a centrifugal pump powered by this Clark Mark TA Gas Turbine in a major products pipeline company. The Mark TA and pump do the same amount of work as two three-stage pumps in series driven by 800-hp diesels . . . and require less space, less maintenance.



CLARK MARK TA GAS TURBINES

FIRST FOR FIVE NEW POWER APPLICATIONS

A products pipeline, two widely differing mining operations, a catalytic cracker, a gas/gasoline plant join the trend to gas turbines for power in field and plant applications. And they choose the Clark Mark TA Gas Turbine because this lightweight packaged unit is demonstrating dual advantages and economies. Power generation is a prime function, but as an operating bonus, its hot exhaust gases can generate process steam, hot water and air.

There are sound reasons for the growing popularity of Clark Gas Turbines. An efficient, single combustion chamber—using gaseous or liquid fuel—provides the design simplicity and dependability required for long service life with minimum maintenance. Thermo-elastic design makes it possible to accept full load quickly without stress. Dual-shaft construction assures maximum speed flexibility for process use. Air cooling makes Clark Gas Turbines ideal for locations where short water supply is a problem.

The Clark Mark TA Gas Turbine is conservatively rated at 1220 bhp, with a normal output speed of 6000 rpm. Three other standard speed models are available. For applications requiring more horsepower, Clark 302 and 305 Gas Turbines are rated up to 9300 bhp.

Your nearest Clark representative has full information on all Clark Gas Turbine models. Or simply write for Bulletins 162 and 163-1 to Clark Bros. Co., 1830 Lincoln Ave., Olean, N. Y.

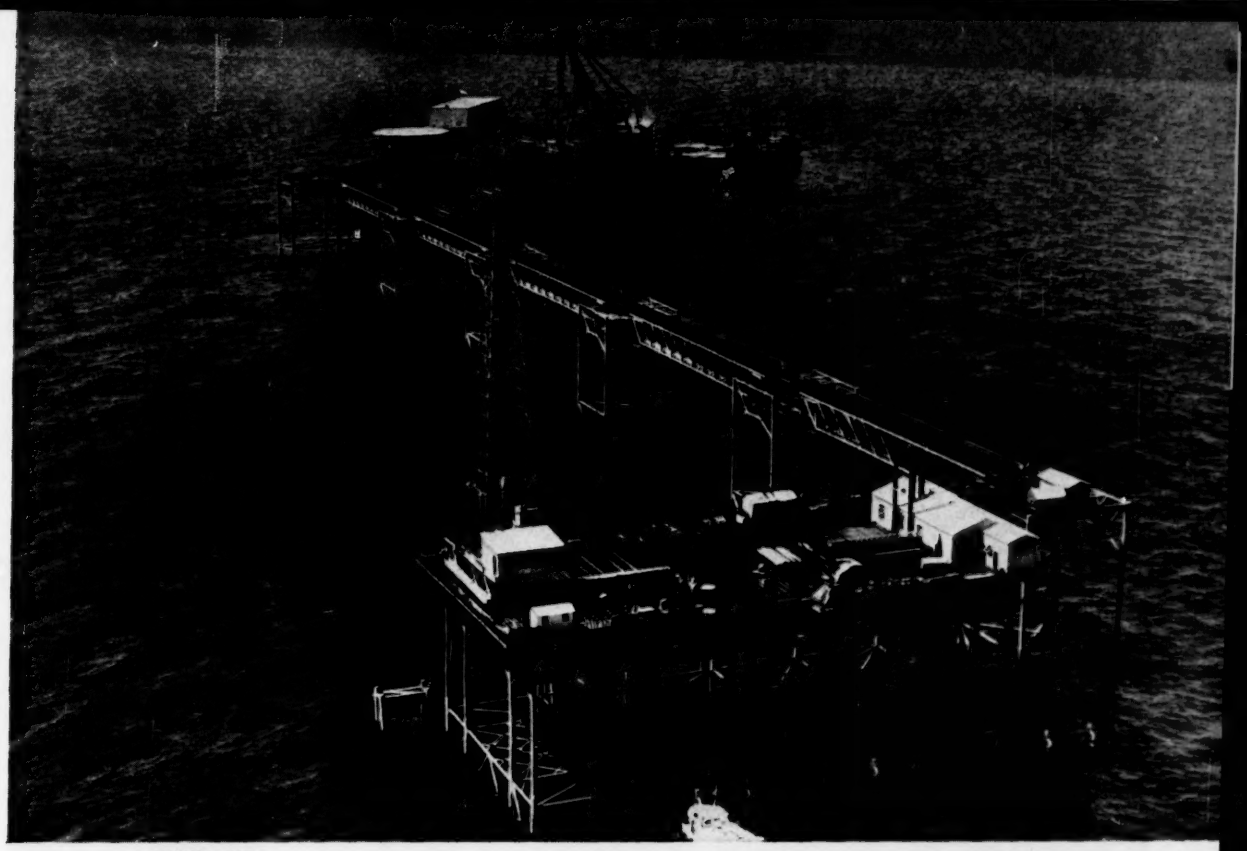
CLARK

CLARK BROS. CO.

OLEAN, N. Y.

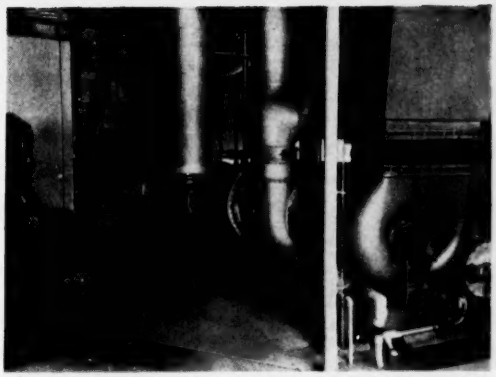
One of the Dresser Industries

COMPRESSORS · ENGINES · GAS TURBINES



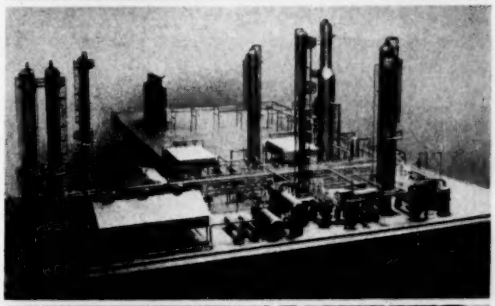
FIRST IN OFFSHORE SULPHUR MINING

Seven miles out in the Gulf of Mexico, Freeport Sulphur Company uses a Clark Mark TA as prime mover in the production of molten sulphur from a deposit 2000 feet below the surface of the Gulf. The Mark TA by driving an electric generator produced power for the drilling rig that put down the production wells (this is the first time a gas turbine has been used on an electric rig). After the main power plant is on stream, the Mark TA will continue in service: (1) Producing part of the plant electrical power used for many vital functions including powering the Clark Balanced/Opposed Compressors supplying the air which lifts the molten sulphur to the surface, (2) Supplying the boilers with hot combustion air which, with supplementary fuel, will generate the steam necessary to heat 5 million gallons of water per day used to melt the sulphur deposit.



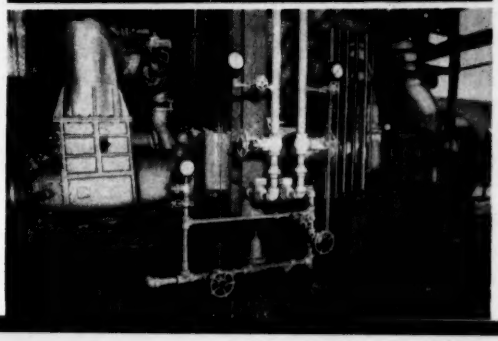
FIRST IN OPEN PIT MINING

This Clark Mark TA driving a generator not only supplies electricity for operation of the Greybull, Wyoming, installation of the Magnet Cove Barium Corporation, but in addition its exhaust gases are used for drying ore. Even discounting the ore-drying bonus, the mine manager reports "better than anticipated fuel economy."



FIRST IN GAS/GASOLINE PLANT

All electric power requirements plus generation of process steam in a waste heat boiler will be accomplished by a Clark Mark TA in the gas processing plant now being constructed for Sun Oil Company near Laverne, Oklahoma (model shown). Initial plant capacity is rated at 100 M.M.s.c.f.d. A projected 50 percent expansion can be accomplished with the same power unit.

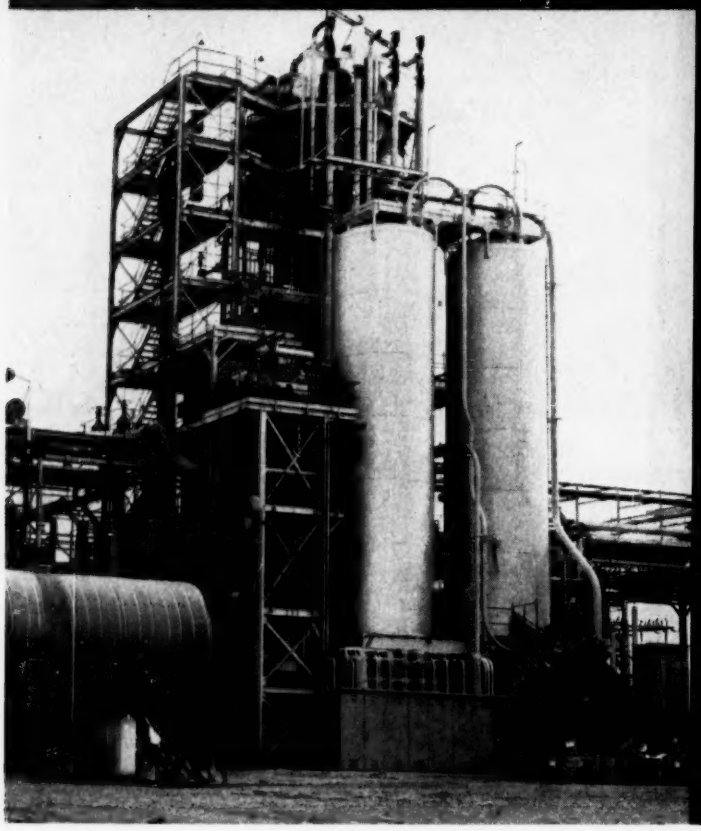


FIRST ON A SMALL CAT CRACKER

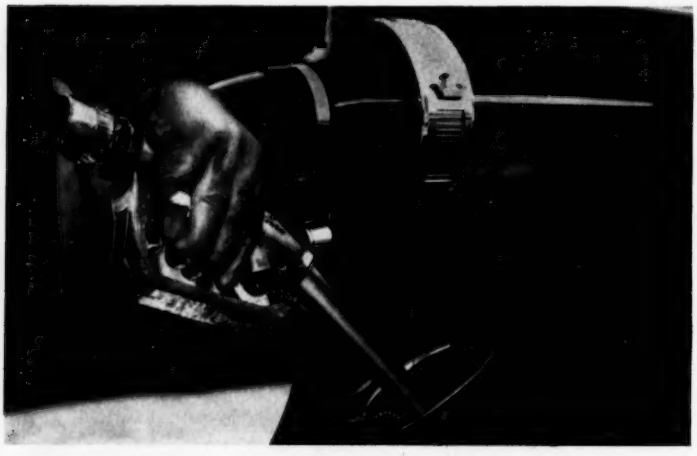
This Clark Mark TA, mounted outdoors, drives a cat cracker blower supplying air directly to a catalyst regenerator at the Duncan, Oklahoma, refinery of DX Sunray Oil Company. Though larger gas turbines have been used in this manner before, the Mark TA is demonstrating the efficiency of smaller applications. The Mark TA Gas Turbine is available through a licensing agreement between Ruston-Hornsby Ltd., Lincoln, England, and Clark Bros. Co.

CYANAMID

Chemical Newsfront



NEW PROCESS IMPROVES PURITY OF PHTHALIC ANHYDRIDE. Over ten years of Cyanamid research and development results in an improved method of manufacturing phthalic anhydride. In operation at Cyanamid's Bridgeville, Pennsylvania plant, the new process involves catalytic oxidation of naphthalene in fluid bed converters—results in greater purity. Similar improvements currently in progress will expand Cyanamid's maleic anhydride capacity at Bridgeville from 14 million pounds annually to 20 million pounds. These developments will enable Cyanamid to meet the increasing needs of the many users of both phthalic and maleic anhydride. (Plastics and Resins Division)

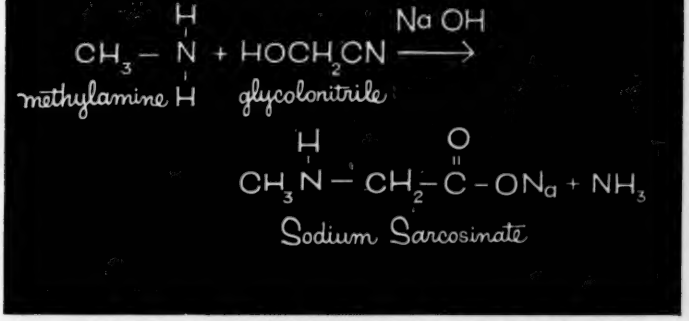


DYE-DUSTING PROBLEMS END FOR GASOLINE REFINERS using Cyanamid's CALCOGAS ROCKET RED. Superior to powdered oil reds, this new red dye eliminates dusting problems in storage and handling. Non-dusting, non-caking and extremely soluble, its granulated form facilitates use in automatic metering and mixing equipment. Because of its non-caking properties, Calcogas Rocket Red resists physical change even at the high temperatures often found in refinery storage areas. In addition to the new Rocket Red Calcogas, Cyanamid also manufactures and sells other exceptionally soluble, dustless colors to the petroleum industry such as Calcogas Orange NC and Calcogas Yellow NC. (Dyes Department)

NEW PAPER INSULATION UPS PEAK TRANSFORMER LOADS 20%. Cyanamid's ACRYLONITRILE has helped General Electric develop a new paper for the insulation system of its pole-type distribution transformers. Paper manufacturer Hollingsworth & Vose produces the new insulating paper from kraft pulp chemically treated with acrylonitrile. In a process known as cyanoethylation, acrylonitrile is added to the pulp to modify its chemical structure and greatly strengthen heat-resistance and retention of dielectric and tensile strength properties. Pulp treated with acrylonitrile also results in substantially improved dimensional stability – important for applications such as map paper and business machine punch cards. **(Petrochemicals Department)**

TEXTILES STAY CLEANER . . . WON'T CLING when treated with Cyanamid's CATANAC® *SN Anti-static Agent*. A small amount of Catanac SN in relation to the weight of the material is usually sufficient for complete control of annoying static electricity. Catanac SN is effective on all fibers, including the synthetics. Application may be made by brush, pad, or spray and, on washable items, by addition to the rinse water. Catanac SN has proved a boon to many industries as well as to the consumer. When used in textile coning oils, for example, it is beneficial in keeping the lubricated material static-free during processing. **(Market Development Department)**

For Example



A BETTER WAY TO MAKE α-AMINO ACIDS. The availability of Cyanamid's AERO Glycolonitrile has made possible the use of an easier and better method for producing α-amino acids. This process is based on the condensation of glycolonitrile with ammonia or amines, followed by hydrolysis of the resulting aminonitrile. By combining hydrogen cyanide with formaldehyde to form glycolonitrile, Cyanamid has greatly reduced the hazards and difficulties encountered in using free hydrogen cyanide. The glycolonitrile route to α-amino acids can result in economic advantages. **(Process Chemicals Department)**

CYANAMID

AMERICAN CYANAMID COMPANY

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

For further information on products in this advertisement wire, phone — or mail this coupon to:

AMERICAN CYANAMID COMPANY
30 Rockefeller Plaza, New York 20, N. Y.
Please send me additional information

- ☐ CALCOGAS ROCKET RED
- ☐ PHTHALIC ANHYDRIDE
- ☐ ACRYLONITRILE
- ☐ CATANAC® SN Anti-static Agent
- ☐ AERO Glycolonitrile

Name_____

Company_____

Position or Title_____

Address_____

City_____ Zone_____ State_____

SOAP DUST

LIME

SILICATE PIGMENT

POLYVINYL CHLORIDE

SODIUM CHROMATE

SODIUM BICARBONATE

DICALCIUM PHOSPHATE

CITRIC ACID

POTASSIUM CARBONATE

BARIUM OXIDE

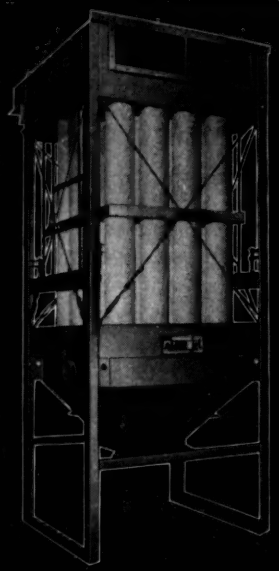
SODIUM FORMATE

BORIC POWDER

AMMONIUM NITRATE

ALUMINA HYDRATE

CARBON DUST



AMERjet—for collection of the very finest particles and particles that must be recovered dry.

CRYSTALLINE DUST

PHOSPHATE DUST

LEAD OXIDE

STARCH DUST

TITANIUM DIOXIDE

ALUMINUM OXIDE

PIGMENTS

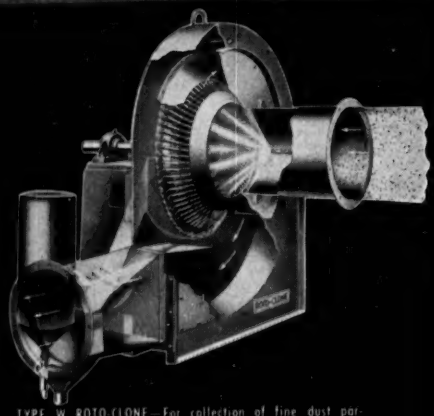
CAUSTIC VAPORS

CARBON DUST

LEAD STEARATE

CLAY

BARIUM SULFIDE



TYPE W ROTO-CLONE—For collection of fine dust particles in moderate concentrations.

TRIPLE TROUBLE

CUPRIC OXIDE

CALCIUM SULFATE

ALUMINA

CARBON BLACK

INSECTICIDES

AZO DYE

VOLCANIC ASH

FUNGICIDE POWDER

FERTILIZER DUST

GLYCERIN VAPOR

PLASTICS

HERMICULITE DUST

LIME

ALUMINUM POWDER

PHOSPHATES

BARIUM CARBONATE

TYPE N ROTO-CLONE—For collection of heavy dust loadings of all particle sizes.

SULPHURIC ACID MIST

ZINC STEARATE

SODIUM CITRATE

BARIUM SULFATE

ALUMINUM SILICATE

T.N.T.

SODIUM SILICATE

AMMONIUM SULFATE

METALLIC OXIDES

BAUXITE

PIGMENTS

PHENOLIC RESINS

FOR DUST!

THESE AAF UNITS DO MANY JOBS FOR CHEMICAL PROCESSORS

The materials at left are but a smattering of the hundreds being efficiently and economically collected for the chemical industry by AAF's AMERjet and wet-collecting ROTO-CLONES.

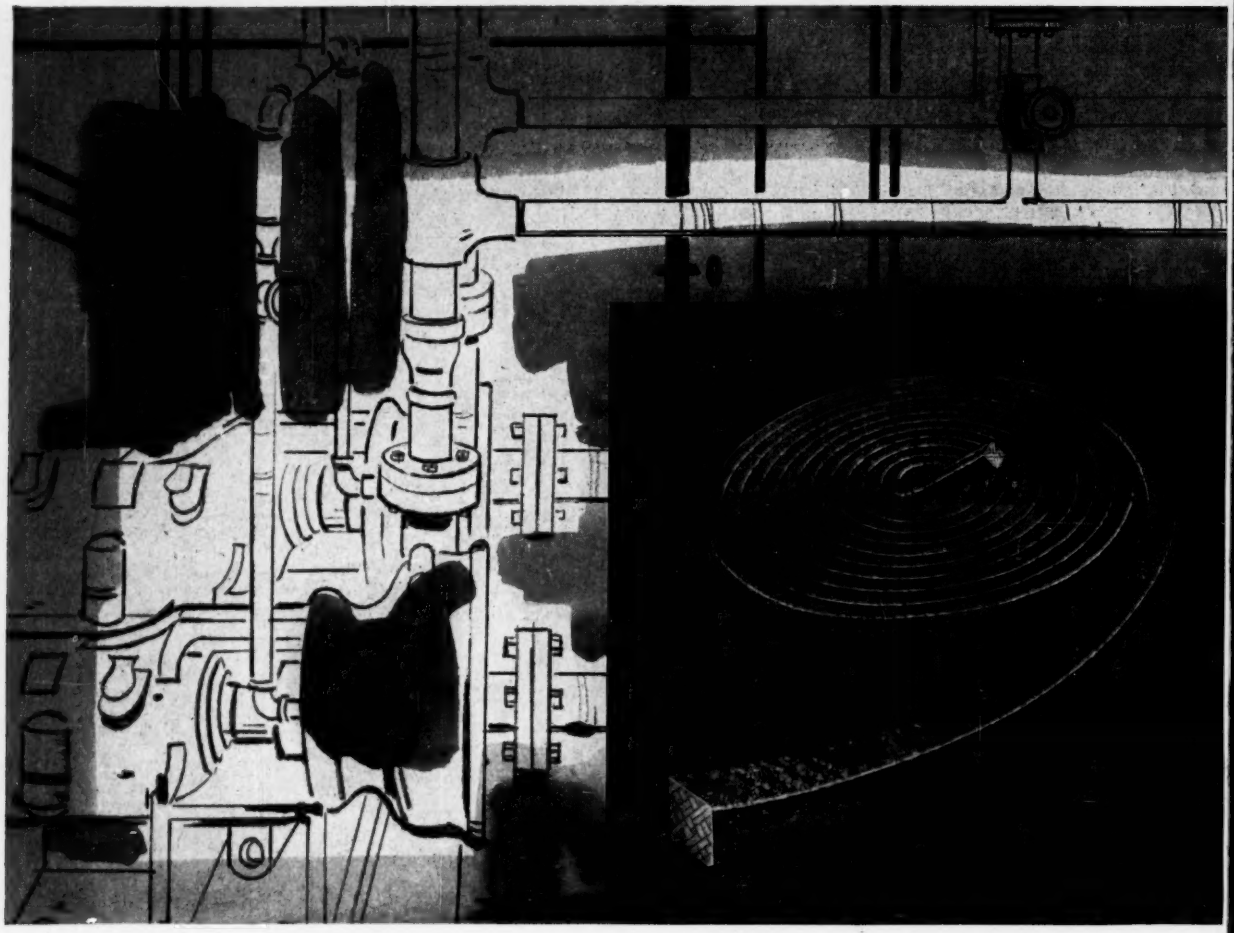
All three units offer these four basic design features: (1) small space requirements, (2) maintained performance over a wide range of operating conditions, (3) constant exhaust volume, and (4) high collection efficiency.

For more complete information on any or all of these units, call your local AAF representative or write direct for Type W Bulletin 272B; Type N Bulletin 277; AMERjet Bulletin 279. Address Mr. Robert Moore, American Air Filter Company, Inc., 326 Central Ave., Louisville, Kentucky.

American Air Filter

BETTER AIR IS OUR BUSINESS

What Garlock Salesmen tell



"LATTICE-BRAID* TEFLON† PACKING IS YOUR BEST BET FOR PUMPS AND ENGINES"

"LATTICE-BRAID TEFLON is just about perfect against chemicals—it's a strong, long-lasting, chemically-inert packing that reduces maintenance and downtime. Let me show you what I mean.

"With LATTICE-BRAID packing, each strand passes diagonally through the body of the packing at a 45° angle. This through-and-through braiding makes a completely unified structure of *greater strength*. Ordinary braided packings become worthless once the single outer cover is worn through. On LATTICE-BRAID, there is no single outer cover; thus, the braiding holds together far beyond the limits of other packings. This, obviously, results in *longer life*.

"On top of this, you have the advantage of TEFLON. It is completely unaffected by the strongest acids, solvents, and alkalies. Co-efficient of friction is extremely low, and it will withstand temperatures ranging from −90° F to +500° F.

"One customer repacked every two weeks on a solvent recovery pump application. He changed to LATTICE-BRAID TEFLON over two years ago and hasn't repacked since."

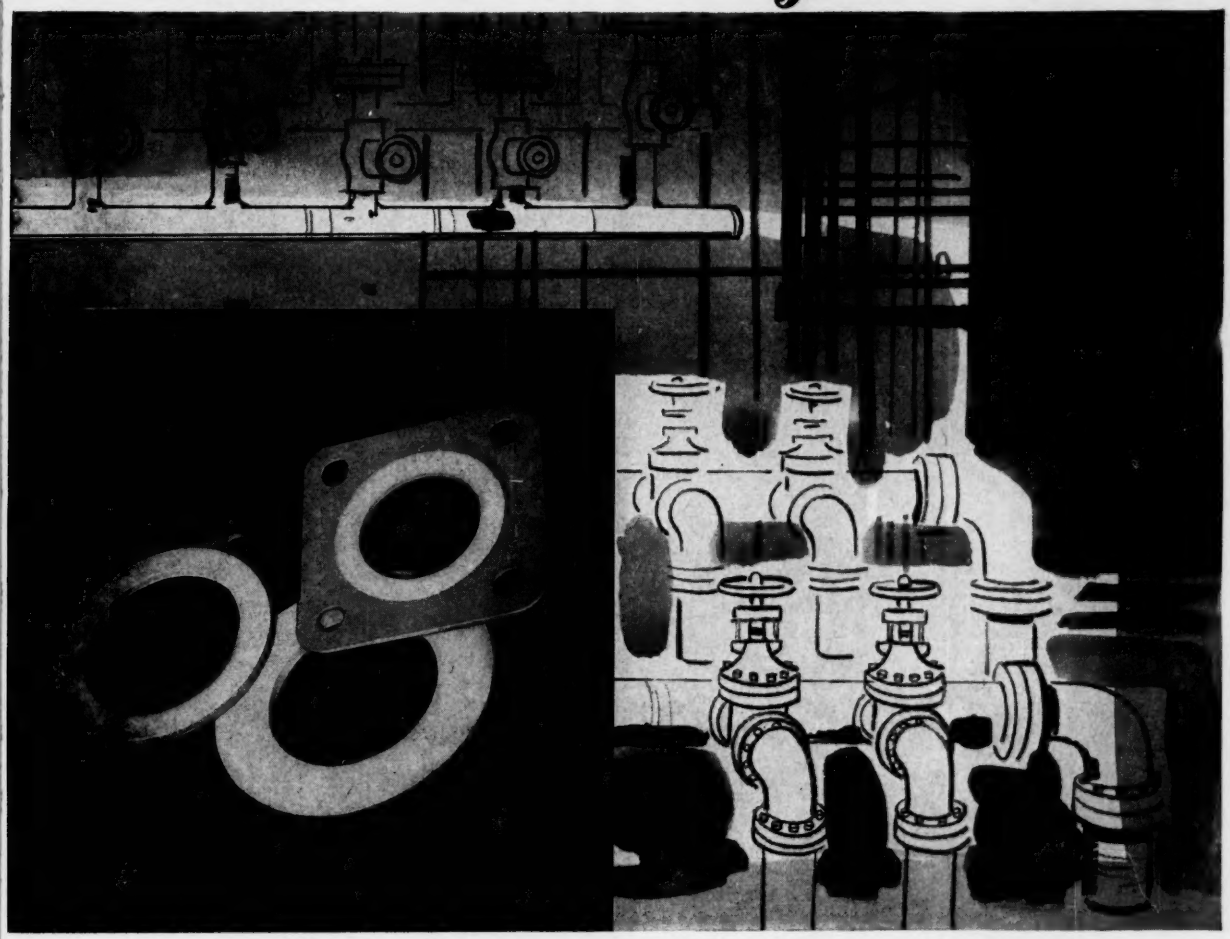
Garlock can furnish you with LATTICE-BRAID packing in a variety of sizes and styles depending on what you need. If you have a particular problem, call our sales office in your area. Or, you can write for further information. Ask for Catalog AD-131.

*Registered Trademark
†DuPont Trademark

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products

Chemical Processing Customers



"BUY LONG-LASTING TEFLON GASKETS FOR PIPING, FLANGES AND FITTINGS"

"With TEFLON jacketed gaskets the outstanding advantage is that you get the fine qualities of TEFLON without sacrificing resiliency and deformability. This, of course, is extremely important on your glass-lined steel piping and process equipment, light metal flanges, and glass pipe flanges and fittings.

"The first step in choosing the proper gasket is to select the type which will work best for you. TEFLON-jacketed gaskets come in four basic designs:

"Once this design is chosen, it's a matter of considering the filler material and thickness. For example, for high pressures, a corrugated stainless steel filler is suggested. Where the application is for glass-lined steel connections with low bolt loads, a rubber filler should be sandwiched between woven asbestos cloth. We offer many different types of fillers, depending on what you need—rubber, asbestos, cork, etc."

Why not let our representative in your area help you select the right gasket design? Discuss your problem with him or write for our Catalog AD-154.

A: Slit Envelope. Teflon stock slit from outside diameter to within 1/8" of inside diameter.

B: Milled Envelope. Teflon stock machined from outside diameter to within 1/32" of inside diameter. Gasket I.D. does not interfere with process flow.

C: Formed Shield for large diameters and irregular opening such as elliptical manholes.

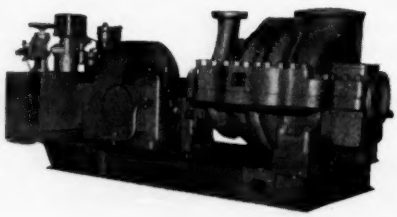
D: Double Jacket. Two jackets overlapping to protect O.D. as well as I.D. For glass-lined steel nozzles.

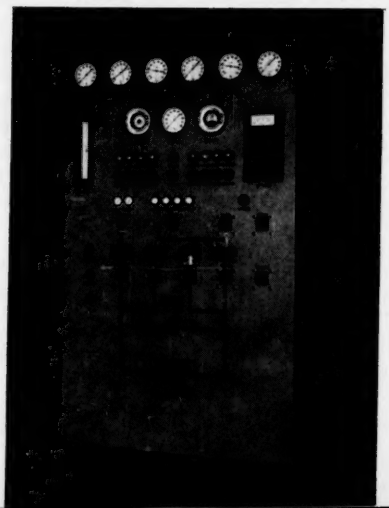
THE GARLOCK PACKING COMPANY, Palmyra, N. Y. For Prompt Service, contact one of our 26 sales offices and warehouses throughout the U. S. and Canada.

CANADIAN DIVISION: The Garlock Packing Company of Canada Limited
PLASTICS DIVISION: United States Gasket Company

Background: *Compressing isobutane in refrigeration-system of alkylation plant of Petro-Tex Chemical Corp.* **Foreground:** *Cutaway of high-pressure seal of Cooper-Bessemer Type RD Centrifugal Compressor.*

Matched to your needs... *A wide range of types and sizes of Cooper-Bessemer Centrifugal Compressors are available to assure optimum performance on your processing or air supply application.*





Undivided responsibility... *We can engineer the entire compressor installation, including drive and controls. Cooper-Bessemer En-Tronic® Controls* provide any degree of automation.

John Fullemann, *Chief Turboproduct Design Engineer, right, and* Kenneth Stevenson, *Turboproduct Designer, The Cooper-Bessemer Corporation, discuss...*

How reliable Cooper-Bessemer Centrifugal Compressors aid 'round-the-clock processing

For example, here's the picture at Petro-Tex Chemical Corp., Houston: The entire sulfuric acid alkylation plant banks on the dependable performance of the Cooper-Bessemer Type RD Centrifugal Compressor which handles isobutane for refrigeration. This unit operates on a continuous, 24-hour basis, handling 11,125 cfm and boosting pressure from 16.2 to 98 psia. Its constant availability is a must.

Of course, many things go into Cooper-Bessemer centrifugals to assure this kind of reliability. For example, take the two-sleeve oil film type seals shown in the illustration. This Cooper-Bessemer design is capable of sealing against pressures of more than 1000 psi, for utmost dependability in processing service.

Bear in mind, too, that the performance of Cooper-Bessemer equipment is backed by an unsurpassed service organization to help protect your plant investment and assure optimum operating economy. For further information, call our nearest office.

BRANCH OFFICES: Grove City • New York • Washington • Gloucester • Chicago Minneapolis • St. Louis • Kansas City • Tulsa • New Orleans • Shreveport • Houston Greggton • Dallas • Odessa • Pampa • Casper • Seattle • San Francisco • Los Angeles

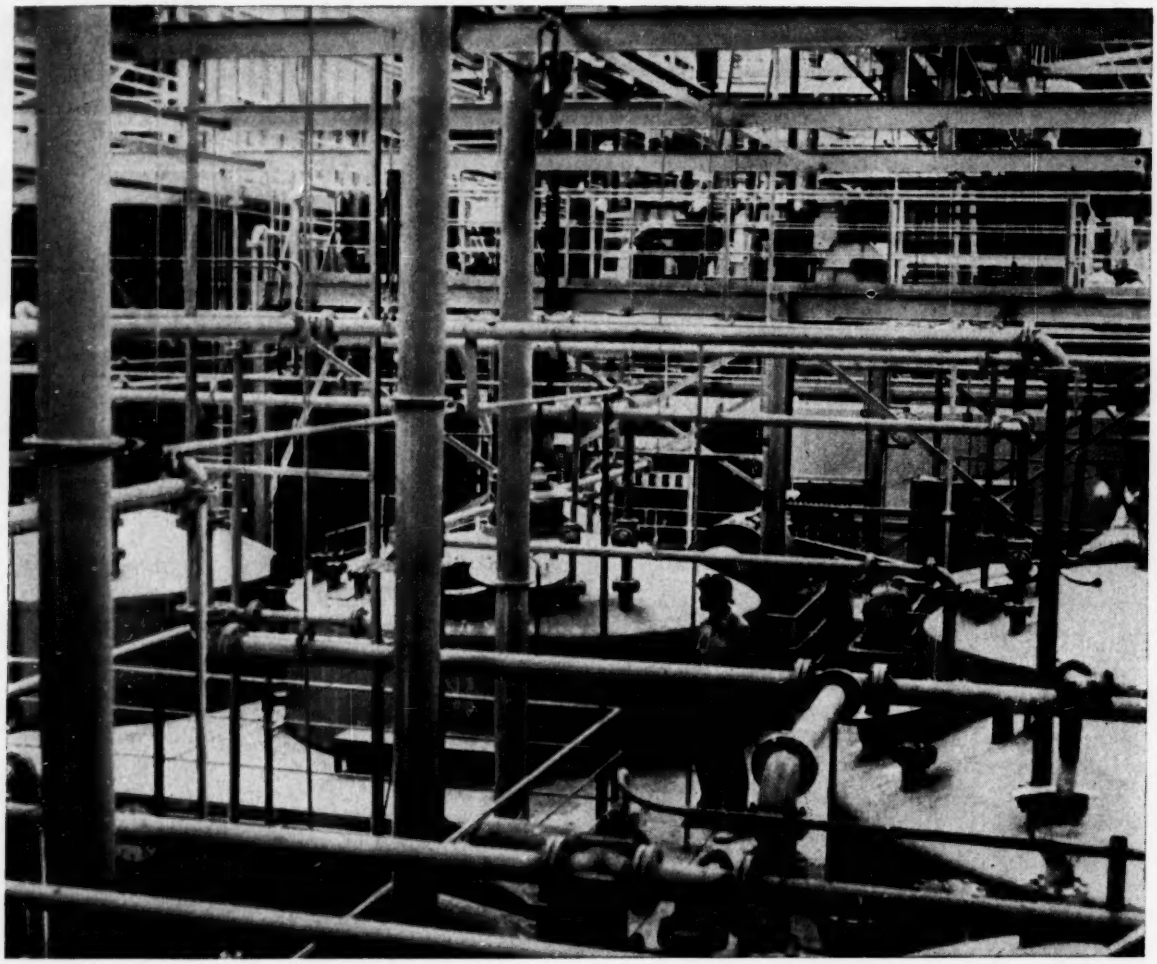
SUBSIDIARIES: Cooper-Bessemer of Canada, Ltd.... Edmonton • Calgary Toronto • Halifax
C-B Southern, Inc.... Houston
Cooper-Bessemer International Corporation... New York • Caracas • Mexico City
Cooper-Bessemer, S.A.... Chur, Switzerland • The Hague, Netherlands

Cooper Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

ENGINES: GAS • DIESEL • GAS-DIESEL
COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINE OR MOTOR DRIVEN

DOW | **SARAN LINED PIPE**



Saran Lined Pipe . . .
process lifeline with a hot acid cargo

When a complex piping system carries corrosive process liquors . . . when it must withstand constant thermal stress imposed by its high-temperature cargo . . . corrosion resistance and high physical strength are the keys to pipeline dependability.

The maze above is of Saran Lined Pipe, and is a part of the process piping at American Cyanamid's Savannah plant, Savannah, Georgia. Most of this pipe carries process liquors with a sulfuric acid content of 25% . . . at temperatures of 165° F. and above. Pumping pressures range upward to a maximum of 70 psig.

The chemical activity and high temperatures of the pipe's contents are severe threats to pipeline durability, but thanks to the extreme corrosion resistance and high strength of Saran Lined Pipe it has performed dependably for American Cyanamid since installation four years ago.

Similar sections of Saran Lined Pipe carry hydrochloric acid in concentrations as high as 37%, while others are used to transfer 10% caustic soda. In many areas other types of corrosion resistant piping have been replaced with new Saran Lined Pipe, with highly satisfactory results.

When processing systems require piping that must resist corrosion and chemical activity, under a wide variety of conditions, consider dependable Saran Lined Pipe. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200° F. They can be cut, fitted and modified easily in the field without special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Department 2280AK9-21.

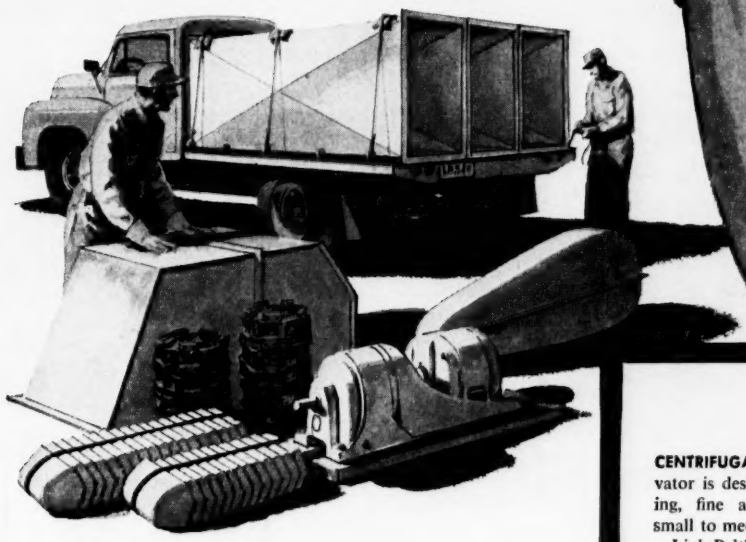
THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

One call, one shipment ...one complete bucket elevator

LINK-BELT makes all bucket elevator components ...all integrated to match perfectly, operate smoothly

There's no delay, no purchasing or installation problems when you call on Link-Belt for your bucket elevator. And when it's up, you can count on long-term elevating efficiency. Reason: Link-Belt makes *everything that goes into a bucket elevator* . . . from head to boot! By carefully designing, manufacturing and integrating all components, Link-Belt minimizes erection time and costs . . . avoids misalignment that causes inefficiency, bucket and casing wear.

At your request, Link-Belt will gladly erect your elevator and accept full installation responsibility. For complete details, contact your nearest Link-Belt office.



LINK-BELT

BUCKET ELEVATORS

CENTRIFUGAL DISCHARGE bucket elevator is designed to handle free-flowing, fine and loose materials with small to medium lumps.

Link-Belt's complete bucket elevator line includes 14 types in 4 basic designs . . . centrifugal, positive, continuous and internal discharge. Also a wide variety of buckets. . . steel, malleable iron, Promal or alloy metals. With this broad selection, Link-Belt can provide the proper elevator and components to meet any material and capacity requirement.

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15,253-A

SPARKLER
horizontal plate
FILTERS

Undisputed First Choice

with engineers who have had occasion to thoroughly test this type of filter. Shown here are structural features that are the result of over 30 years experience in building this one filter. If it could be made better or cheaper Sparkler would have made it that way long ago.

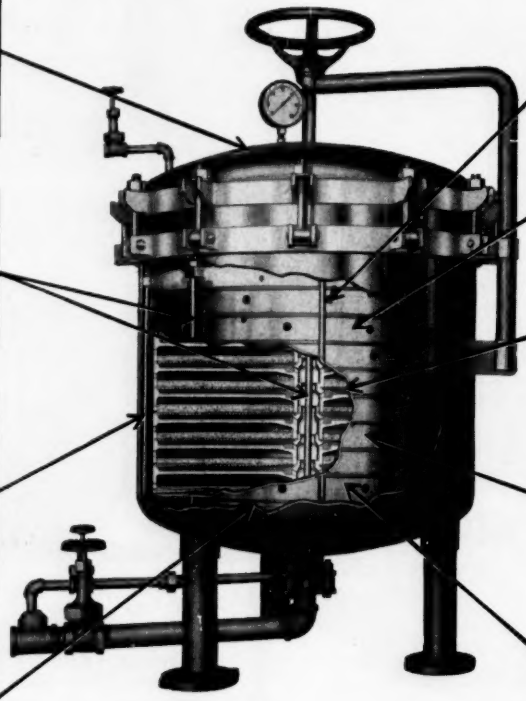
Aloysius C. Kracklauer
Originator of the Horizontal Plate Filter

A.S.M.E. designed construction is standard for pressures up to 60 lbs. on all filter tanks.

Plates sealed independently at center and periphery to assure positive seal.

Plates sealed independent of tank closure to secure a positive seal for both filter plates and for tank cover.

Scavenger plate supported by re-inforced flat bottom tank.



Cartridge plate assembly—removable independently of tank.

Heavy solid plate rings precision machined.

Heavy perforated sheet metal support for filter paper.

A more positive filter seal is obtained when hydraulic pressure is applied to plates externally rather than internally.

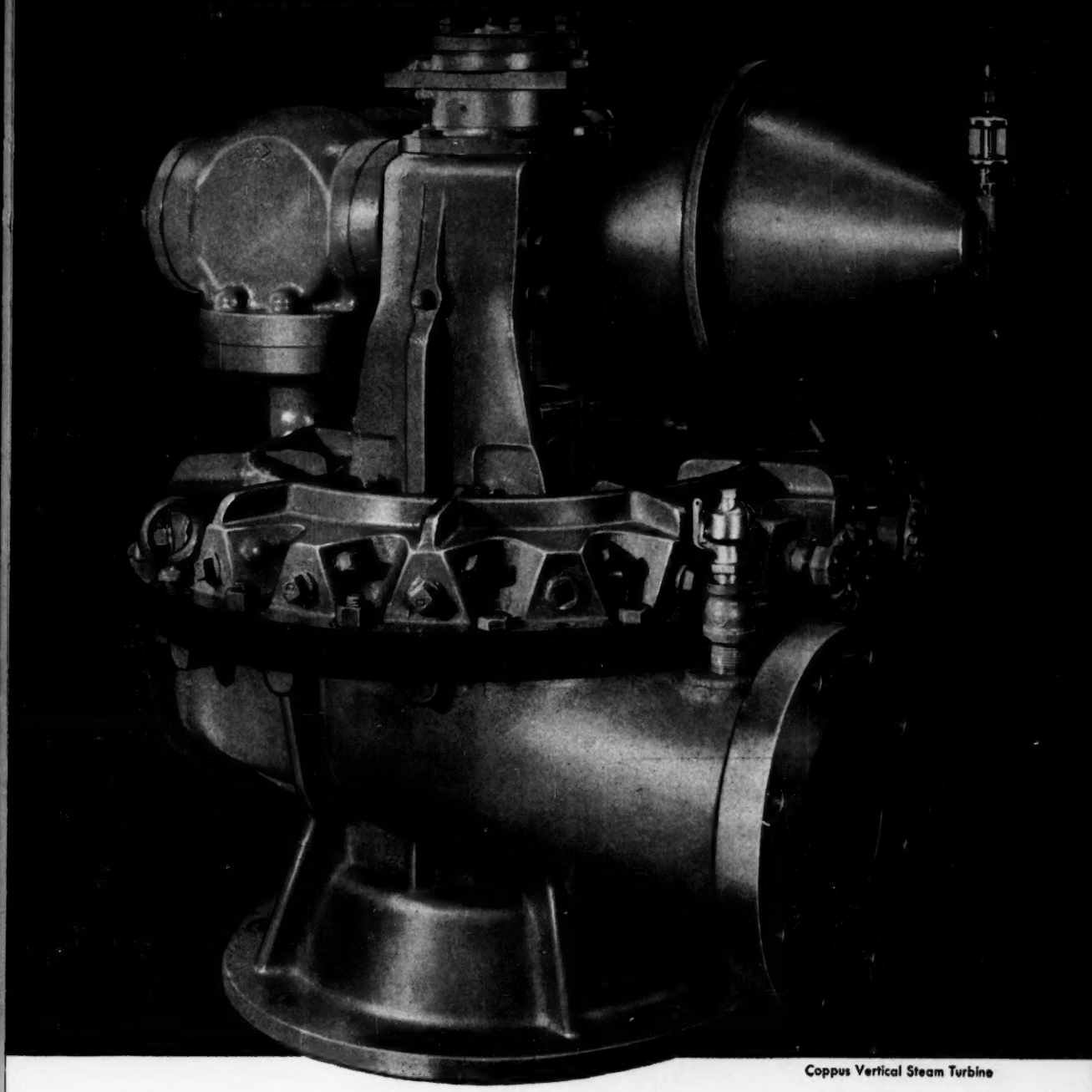
Plate designed to reduce flow friction to a minimum.

SPARKLER FILTERS

The Sparkler, original exclusive horizontal plate design and flow principle, has never been equalled for efficiency and dependability in filtering with any and all types of filter aids. The cake maintains its original position as formed regardless of pressure fluctuation flow rate or viscosity. No break-through is possible, even with a complete shut down of the filter. Filtering can be resumed with perfect safety at any time. With Sparkler plate construction a completely sanitary filter can be furnished.

SPARKLER MANUFACTURING CO. MUNDELEIN, ILLINOIS
Sparkler International Ltd.—Manufacturing plants in Canada, Holland, Italy and Australia.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

COPPUS BLUE RIBBON PRODUCTS



Coppus Vertical Steam Turbine

THE MARK OF QUALITY — There's no better test of a turbine's quality than performance. And the new, ruggedly designed, power-packed Coppus Turbines pass all performance tests with top honors! Small wonder. Coppus quality is literally designed and built into them. Their super stamina is the end-product of painstaking craftsmanship, finest materials and methods, thorough testing and control. Each truly deserves its Blue Ribbon . . . assurance of *complete* reliability.

Typical Coppus Blue Ribbon features are: *totally enclosed governor . . . totally enclosed and independently operated safety trip . . . easily replaceable packing and bearings . . . multiple steam nozzle control . . . brake rim for added safety . . . wide bucket "L" type wheel (optional) for minimum water rate.* You get higher efficiency operation . . . less down time . . . lower maintenance costs.

Coppus Turbines are built to customers' specifications, including API and NEMA standards. Send for Catalog 200. Get complete details on Coppus Turbines. Sizes from 1 HP to 250 HP. Write COPPUS ENGINEERING CORPORATION, 230 Park Avenue, Worcester, Mass. Sales Offices in *Thomas' Register*.

COPPUS
STEAM TURBINES

PRIMARY GYRATORY CRUSHERS

SECONDARY GYRATORY CRUSHERS

JAW CRUSHERS

ROTARY KILNS

BALL MILLS

APRON FEEDERS

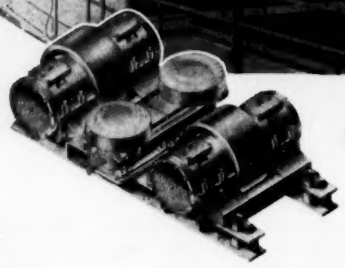
sign of engineering leadership

See the Traylor Display at the Chem Show Booth No. 495 New York Coliseum Nov. 30 to Dec. 4

Traylor

ROTARY KILNS

Leadership in engineering is demonstrated by the Traylor single support type roller bearings. Efficiency of modern rotary kilns depends largely on the roller supports on which they run. Traylor offers the design and perfection of the easy aligning, single roller supports, used on Traylor Rotary Kilns, Coolers, Dryers and Slakers. Traylor Engineers have over fifty years experience in rotary kiln design and manufacture—for more on Traylor-Made kilns write for bulletin No. 1115 today!



THRUST ROLLER MECHANISM WITH TWO BEARINGS SUPPORTING THE ROLLER TIED TOGETHER SO THAT A RIGID MOUNTING IS OBTAINED.

Traylor **ENGINEERING & MFG. CO.**

1190 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

the new look in 50 and 100 ampere electrical connectors!

Supercon ELECTRICAL CONNECTORS

All current-carrying metal parts are machined of high-grade brass and gold-plated for stable electrical contact and resistance to corrosion.

All plastic parts are molded of durable nylon for excellent resistance to corrosive chemicals, heat, oil and grease, abrasion and impact, chipping and cracking.

Pin plugs quickly assembled with a single nut after cable connection.

SOCKET RECEPTACLE

PIN PLUG

Receptacle caps and bodies are color-matched for quick circuit identification in front and back of panel.

Positive-grip functionally designed plugs provide best handling ease and convenience.

Plugs can be connected to a range of cable sizes by fastening screws or by soldering.

PIN RECEPTACLE

SOCKET PLUG

Wide variety of colors permits greater latitude in patchcord distribution layouts.

Socket plug grips are of a simple, two-piece threaded construction for quick assembly.

Six distinctive colors!

THE
SUPERIOR ELECTRIC
COMPANY

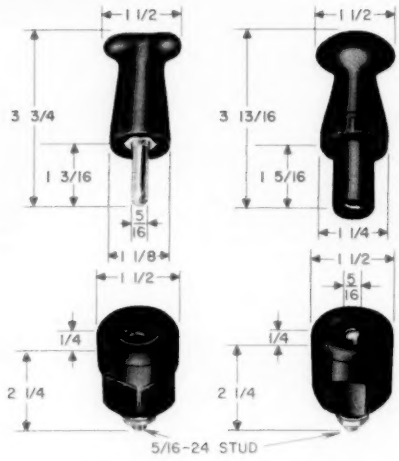
Bristol, Connecticut, U.S.A.

Supercon ELECTRICAL CONNECTORS

for • laboratories • factories • classrooms • testing facilities • research and development centers

REQUIRE 1" PANEL HOLE
1/4" MAXIMUM PANEL THICKNESS

50 AMPERE TYPES



REQUIRE 1 3/16" PANEL HOLE
1/4" MAXIMUM PANEL THICKNESS

100 AMPERE TYPES

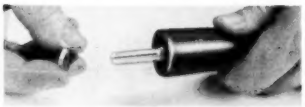
MAXIMUM FLEXIBILITY of power supply boards and distribution panels . . . mobile and portable equipment can be transported to any location . . . stationary patchboards provide centralized control location.

EQUIPMENT SAVINGS are made possible by utilizing one piece of apparatus to do the work of many . . . installation of costly permanent switching gear and wiring is minimized.

RAPID INTERCHANGE and interconnection of electrical apparatus permits many tests or operations to be made and changed in the quickest possible time — set-up time is decreased.

SAFETY AND EFFICIENCY are assured by low-resistance, fully insulated connections . . . circuits can be energized with safety to user and equipment . . . all metal parts recessed for maximum protection.

FAST... EASY... 2 STEP ASSEMBLY

	PIN PLUGS	SOCKET PLUGS	RECEPTACLES
1			
	Attach the cable to the pin plug with the two fastening screws or by soldering.	Slip the socket plug grip over the cable and attach the cable to the socket plug with the screws or by soldering.	After opening the panel hole, screw the cap and the base together securely.
2			
	Slip the grip over the pin plug and tighten in place with the assembly nut.	Screw the socket plug shield and grip together securely.	Attach the wiring by lug, clip-lead, wrap-around or by soldering.

THE SUPERIOR ELECTRIC COMPANY, Bristol, Connecticut

☐ Please send SUPERCON Bulletin.

☐ Please have your representative call.

name

company

address

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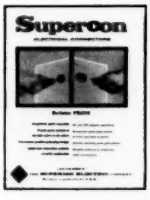
...FOR YOUR FILES

Request SUPERCON Bulletin giving full technical information, ratings and specifications.



THE SUPERIOR ELECTRIC COMPANY
Bristol, Connecticut, U.S.A.

BRIEFS

- on a new form of benzoic acid
- a strategic way to buy alkalies
- finding a "new" intermediate

Crystallized benzoic acid is sneezeless—flows and dissolves faster

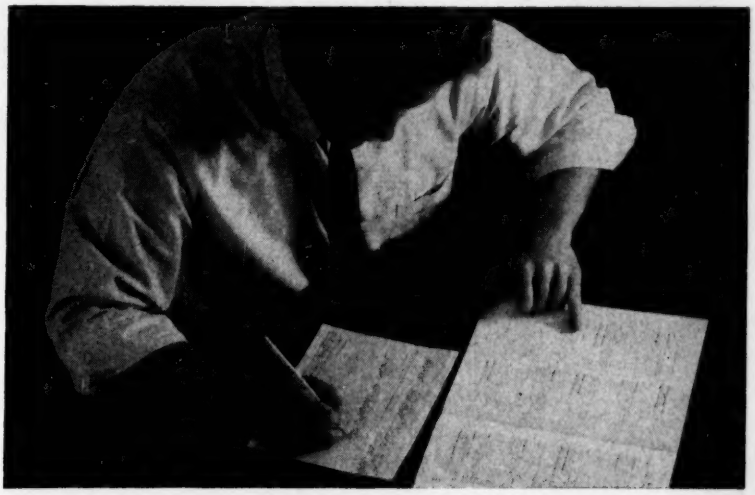
Customers told us there were three ways to improve benzoic acid. Make it dissolve faster. Make it freer flowing. Get rid of irritating fines.

We've done all three with benzoic acid, *crystal.*

You can get this crystal form in both U.S.P. and technical grades. The U.S.P. grade assays 99.3% min. The technical grade is at least 98.0% pure. Water content assays not over 0.2%.

Check the coupon for more data on benzoic acid and its chemical cousin, sodium benzoate, which we also supply in U.S.P. and technical grades.

P.S. You CAN still get the powdered form of benzoic acid if you like. It comes in the same grades and assays the same as the crystal form.



32 ways to buy alkalies

When you have a wide choice of forms and grades of caustic soda, caustic potash, and carbonate of potash, you can gear your purchasing closely to your process or product needs.

You can buy Hooker caustic soda 12 ways, Nialk® caustic potash 13 ways, and Nialk carbonate of potash 7 ways.

Your Hooker contact can help you regarding all forms, grades, and shipping methods.

For descriptive data sheets, just check the coupon.

How to look for a "new" intermediate

Ever spend weeks trying to develop a new intermediate for a project, only to find it has been around all the time?

Maybe you want a new polymerization modifier, for example. Your work points to a mercaptan structure that freezes below 0°C and boils over 100°C, has light color, little odor.

Well, we have been making it all along. We call it lauryl mercaptan.

The coupon tells how to get the data sheet.

For more information, check here and mail with your name, title, and company address.

☐ Benzoic Acid ☐ Caustic Potash ☐ Caustic Soda
☐ Carbonate of Potash ☐ Lauryl Mercaptan

When requesting samples, please use business letterhead to speed delivery.

HOOKER CHEMICAL CORPORATION
409 FORTY-SEVENTH STREET, NIAGARA FALLS, N. Y.

Sales Offices: Chicago Detroit Los Angeles New York Niagara Falls Philadelphia Tacoma Worcester, Mass.
In Canada: Hooker Chemicals Limited, North Vancouver, B. C.

HOOKER CHEMICALS PLASTICS

This is a 1½" Teflon* hose,
actual size,
bending to

A DIAMETER OF 6¾" AT −65° F!

Impossible to produce? TITEFLEX did it, and only TITEFLEX has it! Industry's idea of what flexible Teflon hose in large diameters *can* and *cannot* do has changed overnight.

THESE ARE THE FACTS:

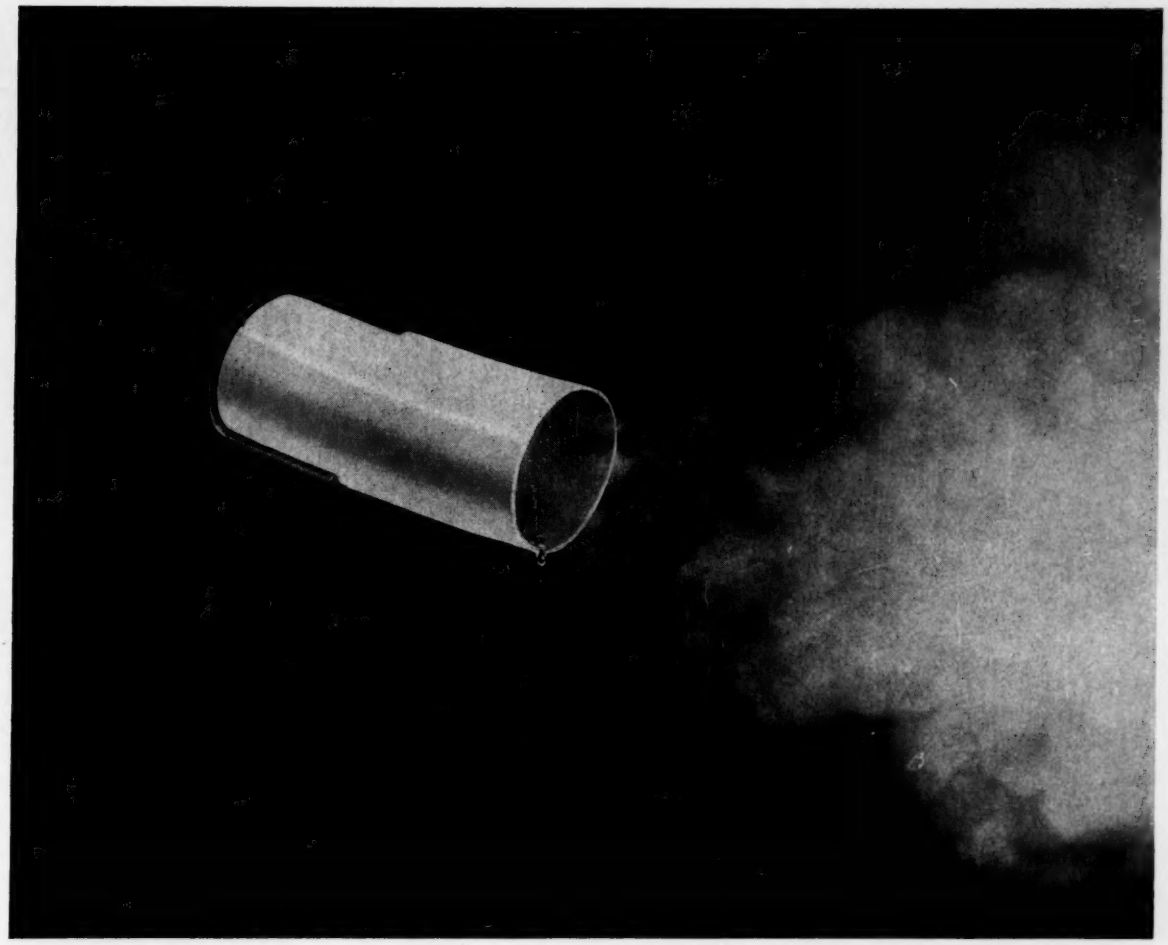
- Minimum bend radius is only 3⅓ times diameter! Available up to 2 inch diameter, lengths to 25 feet.
- It has all Teflon's important features: fatigue life sets endurance records... it's tough, friction-free, light, inert, highly resistant to corrosion and extreme temperatures.
- Teflon innercore is convoluted by exclusive process, and reinforced with TITEFLEX heavy-duty wire braiding.
- Seal faces pressure tight. Braid, innercore and fittings are made practically one by the TITEFLEX method.

Already Springfield "400" is in use for live steam, alcohols, methanol and corrosive fluids. New uses for the toughest jobs are found every day... how about your operation? Get a copy of our bulletin from your TITEFLEX Distributor (in the Yellow Pages). Or drop us a line.

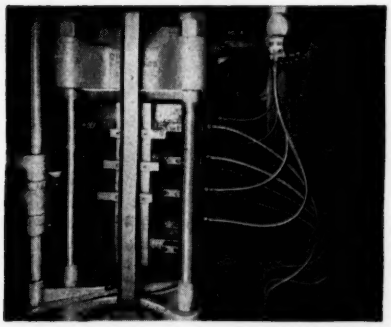
titeflex

titeflex inc. springfield mass. PACIFIC DIVISION • SANTA MONICA • CALIFORNIA

*T.M. of duPont
**T.M. of Titeflex, Inc., Pat. Pend.



Meet your needs for HEAT RESISTANCE with hose of Du Pont TFE resins



Connections on this platen press carry 350° F. steam and condensate, alternating with 45°F. water. Hoses lined with TEFLON have withstood this service continuously since May, 1955, with no signs of cracking or wear. The anti-stick properties of the TFE resin markedly reduced plugging from scale formation.

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

When hose lines must handle substances at high temperatures, and at the same time must withstand other rugged service conditions, hose lined with a TEFLON TFE-fluorocarbon resin provides an effective solution. TFE resins are rated for continuous use up to 500°F.; they are unaffected by virtually all acids and solvents; their "waxy" surface reduces contamination and holdup problems to a minimum. Hose lined with TEFLON will handle superheated steam, yet is useful even in liquid-oxygen service. And now, new constructions especially for industrial applications include fiber reinforcements, elastomeric coverings, convoluted tubing for greater flexibility, and a variety of industrial couplings.

In short, the unique combination of properties offered by hose lined with TFE resin makes it ideal for the most demanding applications in the chemical and petrochemical industries. For maximum service, minimum maintenance and replacement costs, consider using hose lined with TFE resins in your processes.

Ask your dealer, or write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, RoomT-10821,Du Pont Bldg., Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DU PONT TEFLON®

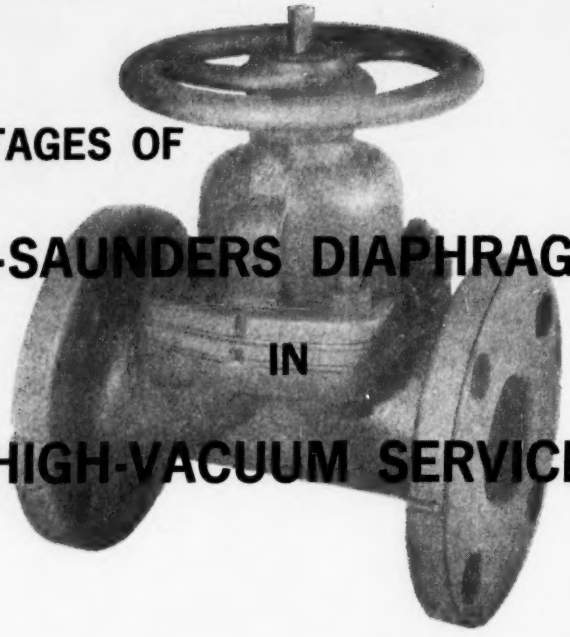
REG. U. S. PAT. OFF.

TFE-FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

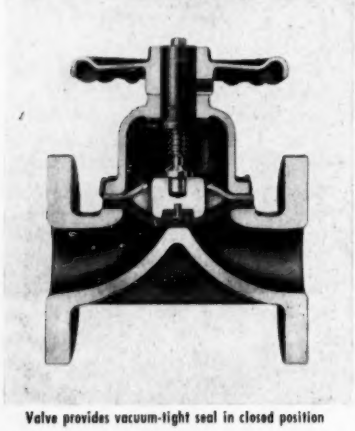
GRINNELL REPORTS ON VALVES:

THE ADVANTAGES OF GRINNELL-SAUNDERS DIAPHRAGM VALVES IN HIGH-VACUUM SERVICE



Dependable performance and long service life for vacuums down to 0.1 micron . . . with leak rates of less than 0.1 micron cubic foot/hour

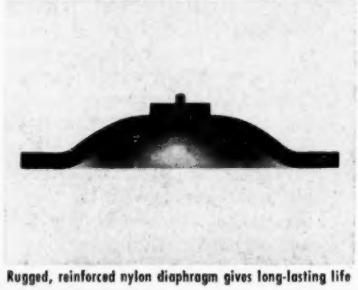
One of the most important requirements of valves for high-vacuum service is that they must be vacuum-tight at all times during their operating cycle. Diaphragm valves of the Grinnell-Saunders manufacture fully meet this requirement. When clamped between the flanges of the body and bonnet, the diaphragm is easily made vacuum-tight down to 0.1 micron — with an in-leakage rate of less than 0.1 micron cubic foot/hour. Whether in the open, throttling or closed position, the diaphragm presents a smooth, unbroken face to the vacuum side of the chamber.



Valve provides vacuum-tight seal in closed position

Rugged, nylon-reinforced diaphragms in a variety of materials

Grinnell has perfected a method of reinforcing its diaphragms with wear-resistant nylon. The result is a diaphragm that lasts longer at high-vacuum. The only part of the valve subject to service wear at any time is the diaphragm — which can easily be replaced in a matter of minutes, without removing the valve body from the system. Diaphragms are available in a wide choice of materials.



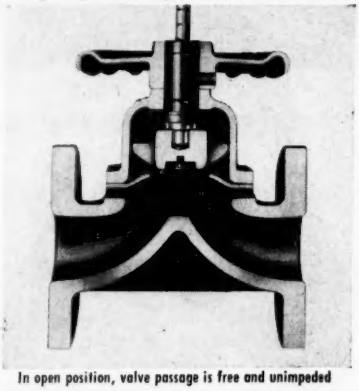
Rugged, reinforced nylon diaphragm gives long-lasting life

Contamination minimized

Construction of Grinnell-Saunders Diaphragm Valves provides separation of the working mechanism from the vacuum within the system. This isolation of lubricated working parts prevents contamination of the system from lubricant outgassing.

Large, unimpeded valve passage

The large passage of the Grinnell valve, in the open position, offers minimum impedance to the escape of random moving molecules in pumping down to high-vacuum, thus shortening the pump-down cycle.



In open position, valve passage is free and unimpeded

Special provisions:

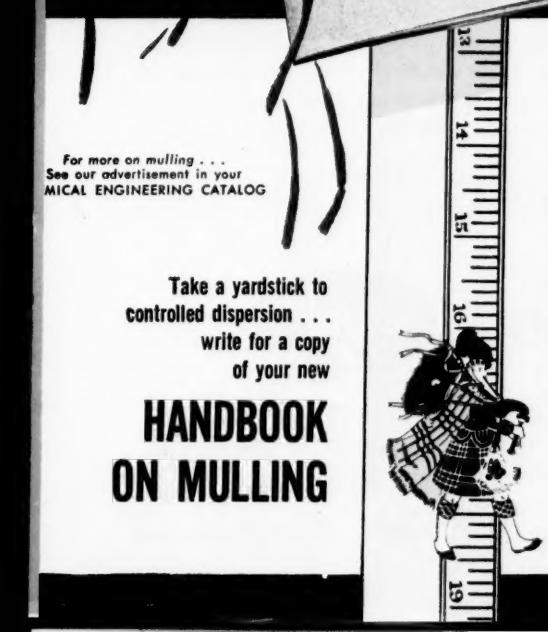
Sealed bonnets are available for evacuation when required. Elastomer type diaphragms do not require evacuation of the bonnet. Valves with plastic diaphragms, used at elevated temperatures, do require evacuation of the bonnet for long diaphragm service life.

For more information

Get further facts about Grinnell-Saunders Diaphragm Valves. Learn how the diaphragm lifts high for streamline flow in either direction . . . and how the diaphragm seals firmly against the body weir for leak-tight closure. Write to: — Grinnell Company, Providence 1, Rhode Island.

Here's the new HANDBOOK on MULLING

...take a measure of MIXING EFFICIENCY



For more on mulling . . .
See our advertisement in your
MICAL ENGINEERING CATALOG

Take a yardstick to controlled dispersion . . . write for a copy of your new

HANDBOOK ON MULLING

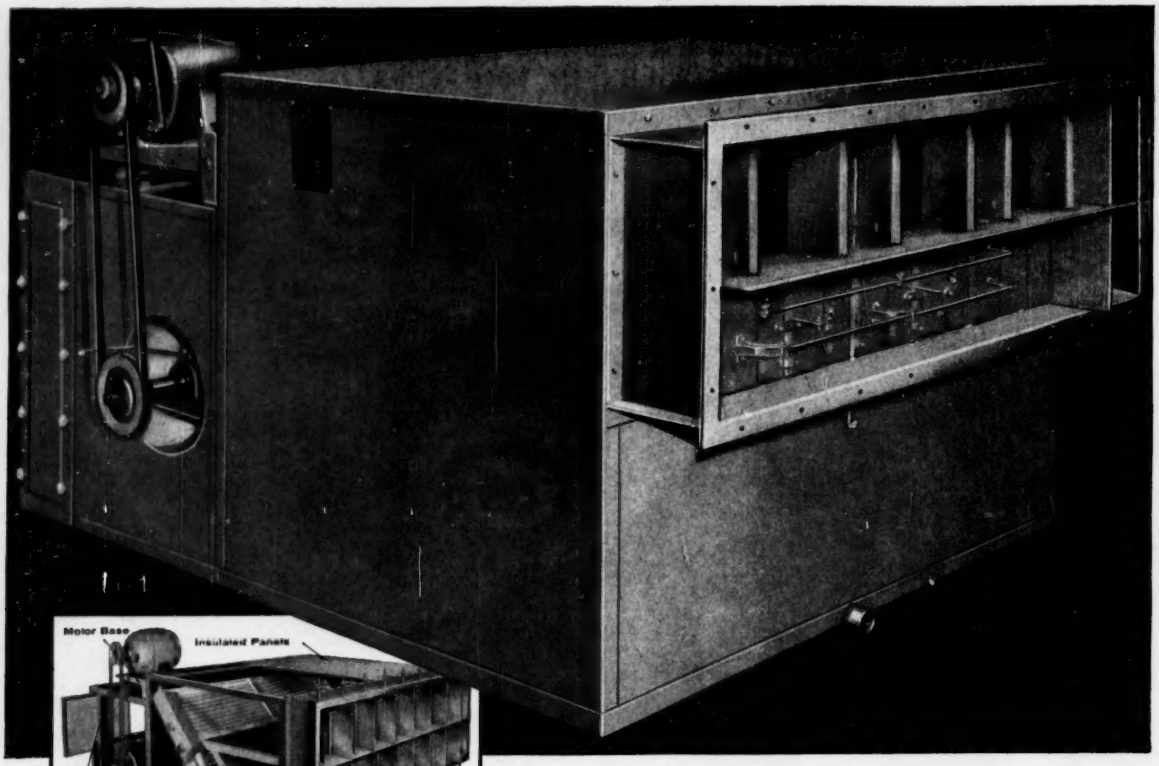
Will *your* materials preparation facilities *measure up* to the production and quality control standards that are already in sight for the '60s?

If you are in doubt and you mix dry solids, this 12-page bulletin is specifically designed to make you dissatisfied with "hit or miss" mixing practices. It reveals how *controlled dispersion* can be easily achieved in this era of high purity—high uniformity raw materials. And, how it is being achieved by Mix-Muller users . . . processors who have already realized that "cement mixer technology" takes an expensive toll at today's raw material prices.

P759

SIMPSON *MIX-MULLER*® DIVISION

636 MACHINERY HALL BLDG., CHICAGO 6, ILLINOIS



ACCURATE TEMPERATURE CONTROL PROVIDED BY "BUFFALO" ZONE CONTROL CABINETS

"Buffalo" Zone Control Cabinets are engineered for installations where a single unit must provide varying degrees of conditioned air for several zones or rooms. These quiet operating compact units perform with peak economy, flexibility and dependability.

Temperature is controlled by mixing cooled and heated air in just the right proportions to suit each conditioned space. The need for separate re-heat coils and their controls is completely eliminated. Control for each area can be manual or entirely automatic.

"Buffalo" Zone Control Cabinets are sectionalized for maximum ease of installation. Removable panels and bearings located outside the cabinet simplify servicing. The entire unit is sturdily constructed to insure a long life of maintenance-free operation.

You're sure of satisfactory results when you specify "Buffalo" Zone Control Cabinets. Your "Buffalo" engineering representative will be pleased to provide you with information concerning unit selection, installation, etc. Contact him, or write us direct for Bulletin AC-220.

All "Buffalo" equipment brings you the "Q" Factor — the built-in QUALITY which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY
BUFFALO, NEW YORK
Buffalo Pumps Division • Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING
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How "Mr. Inside" and "Mr. Outside" Can Help You Cut Maintenance Costs

They provide quick access to your nearby Steel Service Center and their complete stocks of Armco Stainless Steel

MR. INSIDE'S specialty is quick service. He is the inside salesman for your distributor of Armco Stainless Steels, and he's as close to you as your phone. When you need stainless in a hurry, he can give you information on grades, prices, and availability in a matter of seconds, and have your order on its way soon after you call. He's helpful at all times—in emergencies can help you cut costly down-time to a minimum.

MR. OUTSIDE is your Armco Distributor's field representative. His thorough knowledge of stainless steels and their fabrication can be helpful in solving your metal problems. His experience with Armco Stainless and his company's many services can also be helpful in planning for most economical long range maintenance. He'll be glad to work with you or your equipment suppliers.

Besides these men, who know stainless and where it should be used in chemical processing equipment, your Steel Service Center maintains complete stocks of Armco Stainless Steels in the sizes and shapes you need. Call now and check the money- and time-saving services they provide. Or, send us the coupon for the name of the Armco Stainless Steel Distributor nearest you.

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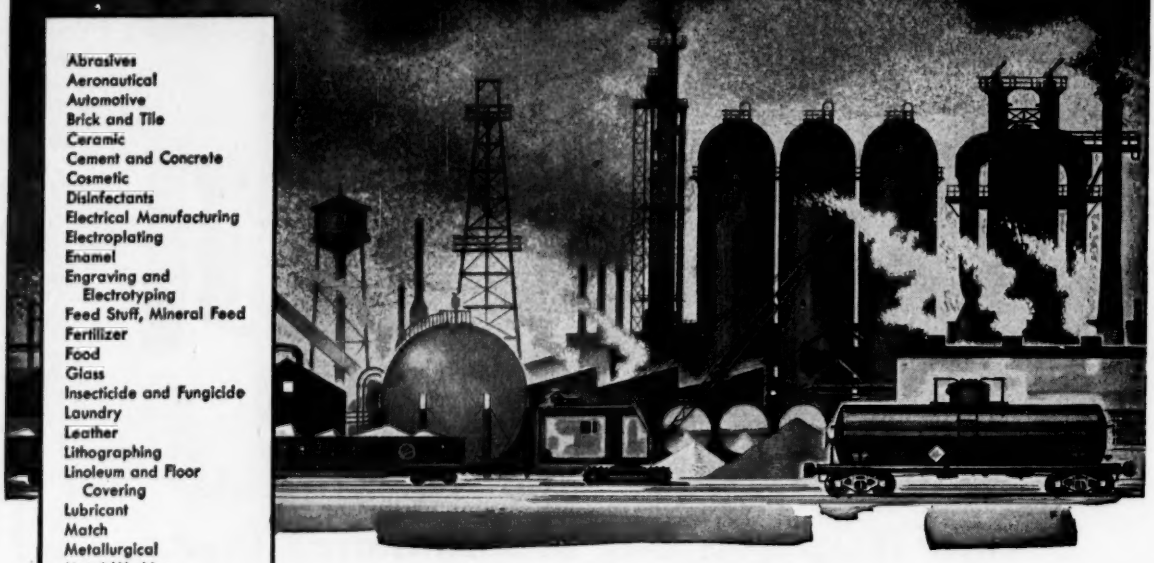

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- Aeronautical
- Automotive
- Brick and Tile
- Ceramic
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- Electroplating
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Harshaw sells chemicals — thousands of them — for these and many other industries

Here are typical Harshaw chemical products

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- Glycerine
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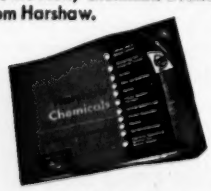
FREE! This 16-page booklet lists the many chemicals available from Harshaw.



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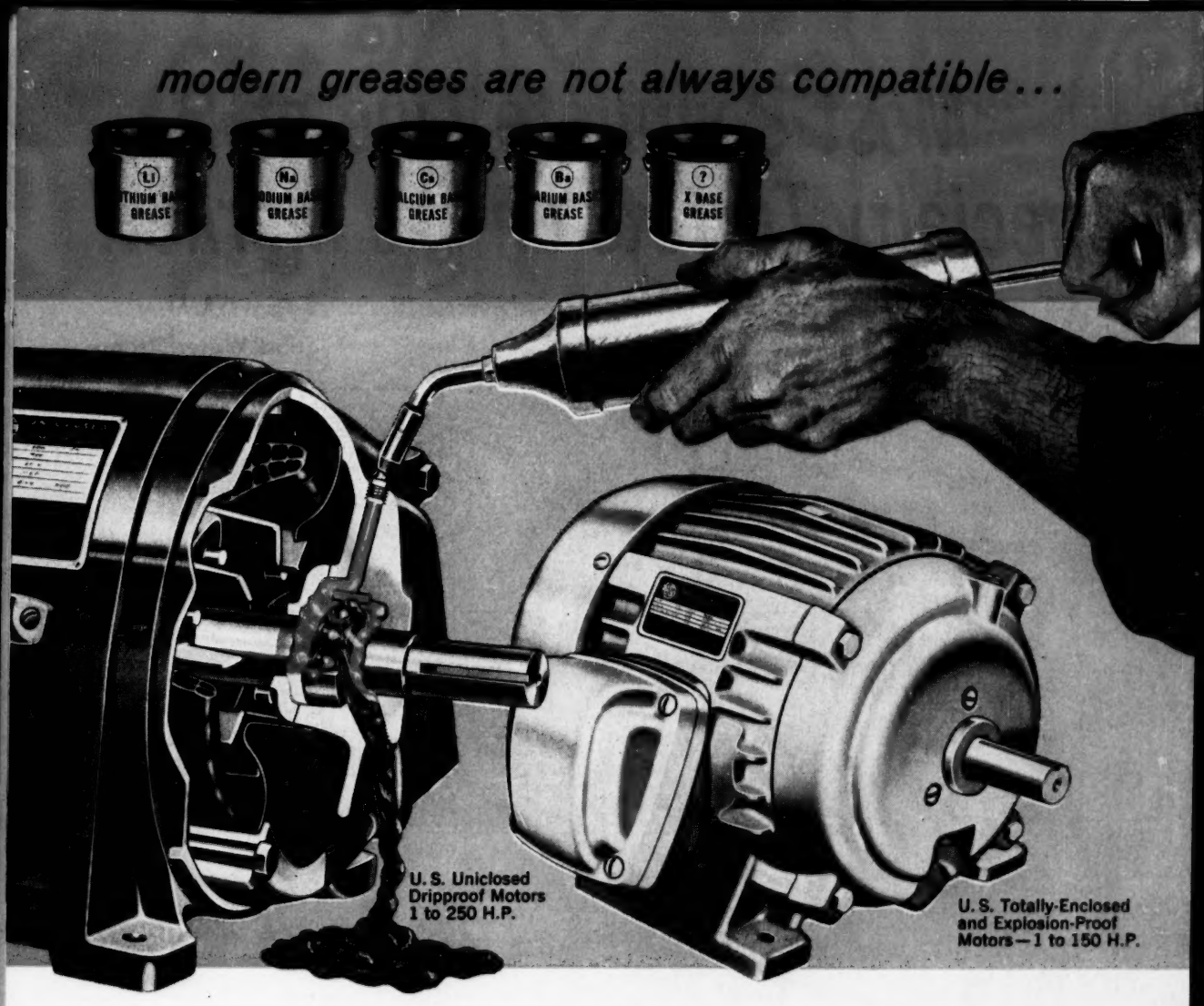
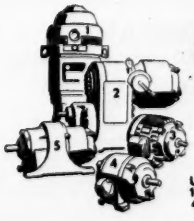


...that's why it's important to assure

complete flush with Lubriflush*

***exclusive feature of U.S. MOTORS**

Today's greases have many different chemical bases – lithium, sodium, calcium, barium, and others. Some of these chemical bases react when mixed, making mixed grease unsuitable for bearing lubrication. That is why U.S. LUBRIFLUSH – an exclusive U.S. feature – is so important. With LUBRIFLUSH transverse lubrication, new grease *completely* flushes out the old. No mixing! New grease may be put in without bothering to determine whether it's basically compatible with the grease already in the motor. LUBRIFLUSH, moreover, assures proper lubrication for *longest bearing life!* Another good reason to specify: "U.S. ELECTRICAL MOTORS."



U.S. ELECTRICAL MOTORS INC.

P. O. BOX 2058, LOS ANGELES 54, CALIFORNIA
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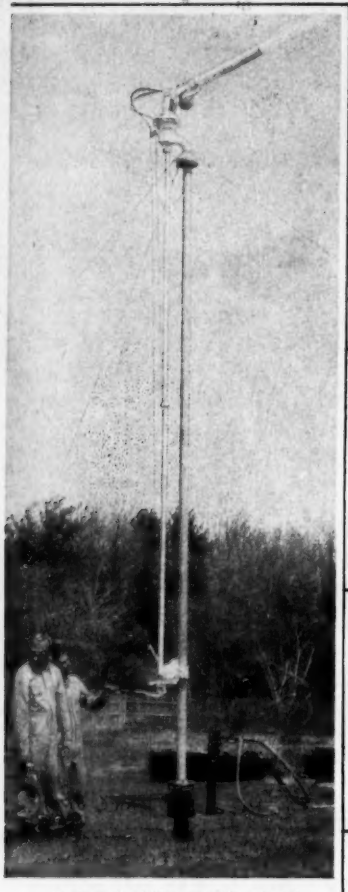
U.S. MAJOR MOTOR LINES INCLUDE:
1. Vertical Solid & Holloshaft, 2. Varidrive, 3. Totally-Enclosed, 4. Uniclosed, 5. Syncrogear. Also, many other special motors.

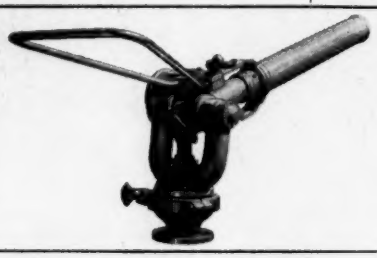
FREE COLOR BROCHURE
...for full information send for FREE Lubriflush Bulletin.

Most Complete Line of Specialty Turrets on the Market!

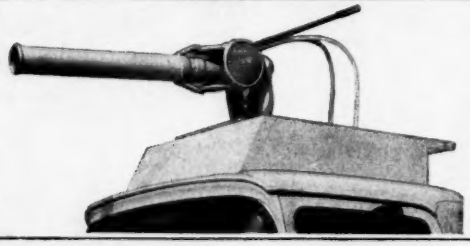


Extended Manual Control Type — Turret nozzles extend 10 to 20 feet above remote control station on deck or ground on standard units . . . greater remote extensions for special applications.

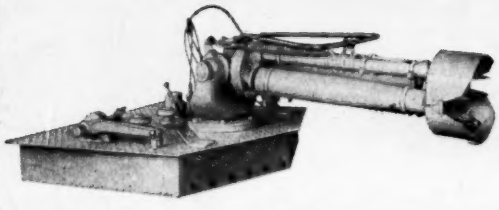
***...All Rockwood Turrets Discharge* FogFOAM**
Solid FOAM Stream — WaterFOG — Solid Water Stream



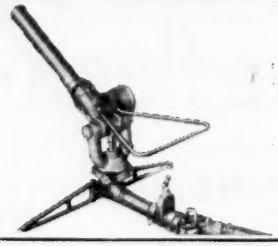
Direct Manual Control Type — Gives fire fighters "out-in-the-open" control from cab roof!



Remote Manual Control Type — Easily handled by man in driver's seat. Ideal for fast action!



Remote Hydraulic Control Type — Power-controlled from within the cab. Single and dual models. Widely used on air crash rescue fire-fighting trucks.

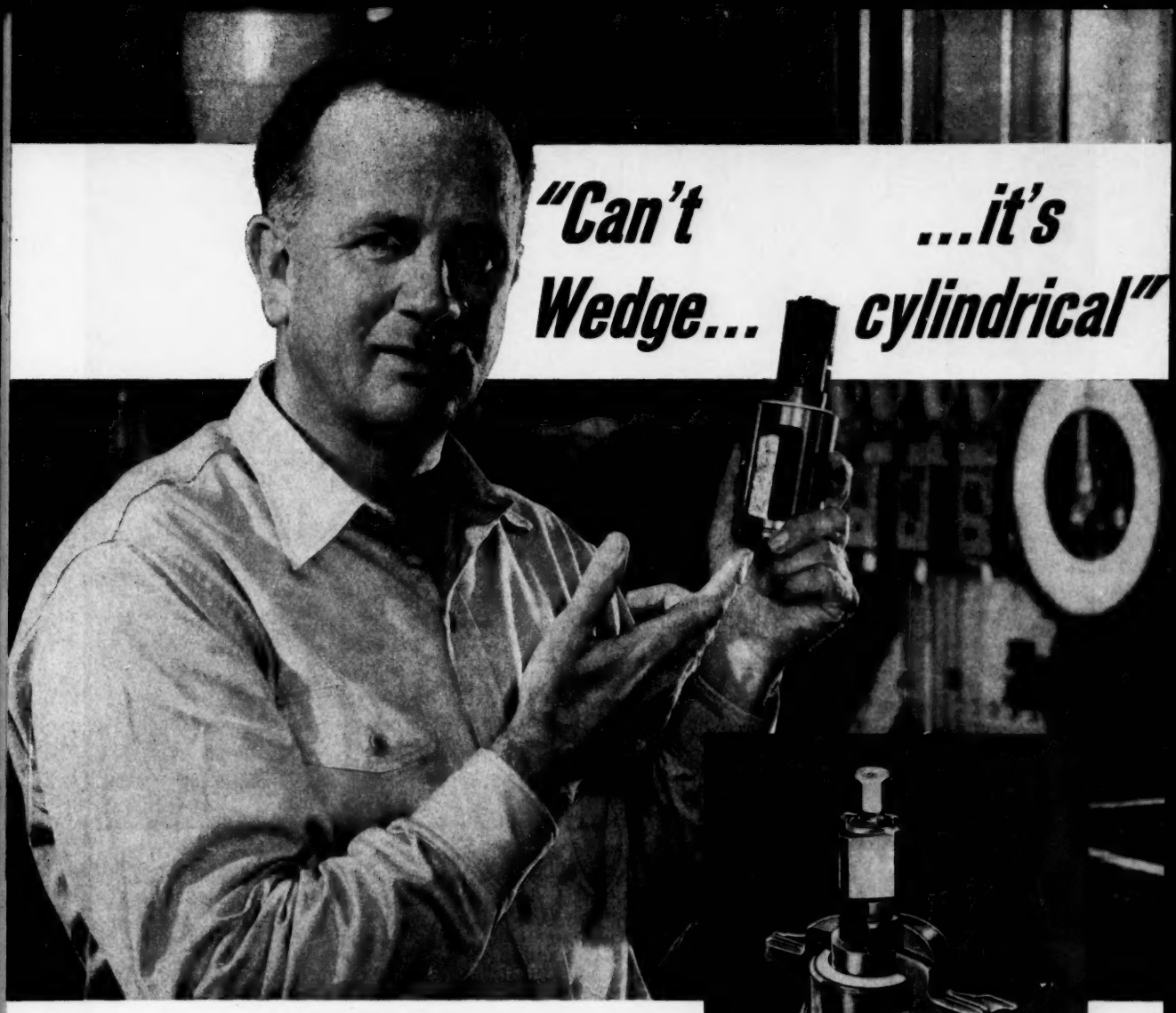


Portable Type — Off the truck and into action in seconds! Goes wherever a fire fighter can bring the proper hose line into action!

On the truck or on the ground, fire fighters can hit fires *harder* using ROCKWOOD Turrets! At airports and refineries . . . in municipalities and throughout industry . . . these advanced-design fire-fighting aids are constantly proving their ability to extinguish fires faster.

ROCKWOOD Turrets provide plenty of volume *and* versatility. What's more, all are easily adjustable on the fire line to meet changing fire conditions. Produced by the world's largest manufacturer of specialty Fire-Fighting Turrets, they're designed to give fire fighters an extra edge of efficiency on most types of fires. Get full details on the complete line of fire-fighting products. Write ROCKWOOD SPRINKLER COMPANY, Portable Fire Protection Division, 523 Harlow Street, Worcester 5, Massachusetts.

ROCKWOOD SPRINKLER COMPANY
A Division of The Gamewell Company
Engineers Water ... to Cut Fire Losses
Distributors in all principal cities.



acf®
Lubricated Plug Valves

There's no taper to cause sticking or wedging in an ACF valve. And the plug can't be unseated.

The baseplate spring and line pressure hold the plug tight against the Teflon head seat gasket. All friction surfaces are constantly lubricated for easy quarter-turn operation and protection against corrosion.

Next time — and every time — specify ACF! *Available from leading suppliers everywhere.*

Product of W-K-M's *Creative Engineering*

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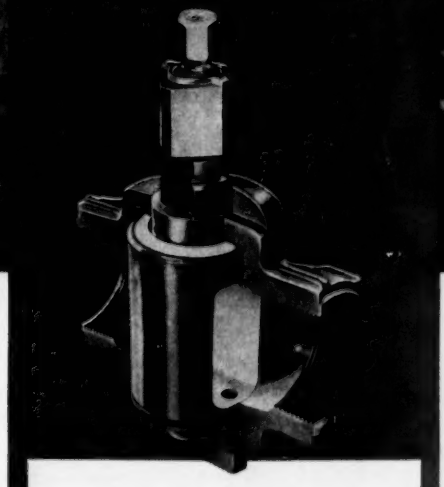
W-K-M Division of ACF Industries, Incorporated P. O. Box 2117, Houston, Texas

W-K-M *40* SERVING INDUSTRY YEARS



ACF semi-steel lubricated Plug Valves are available in rectangular, round, diamond, and V ports; venturi, multiport and steam-jacketed models.

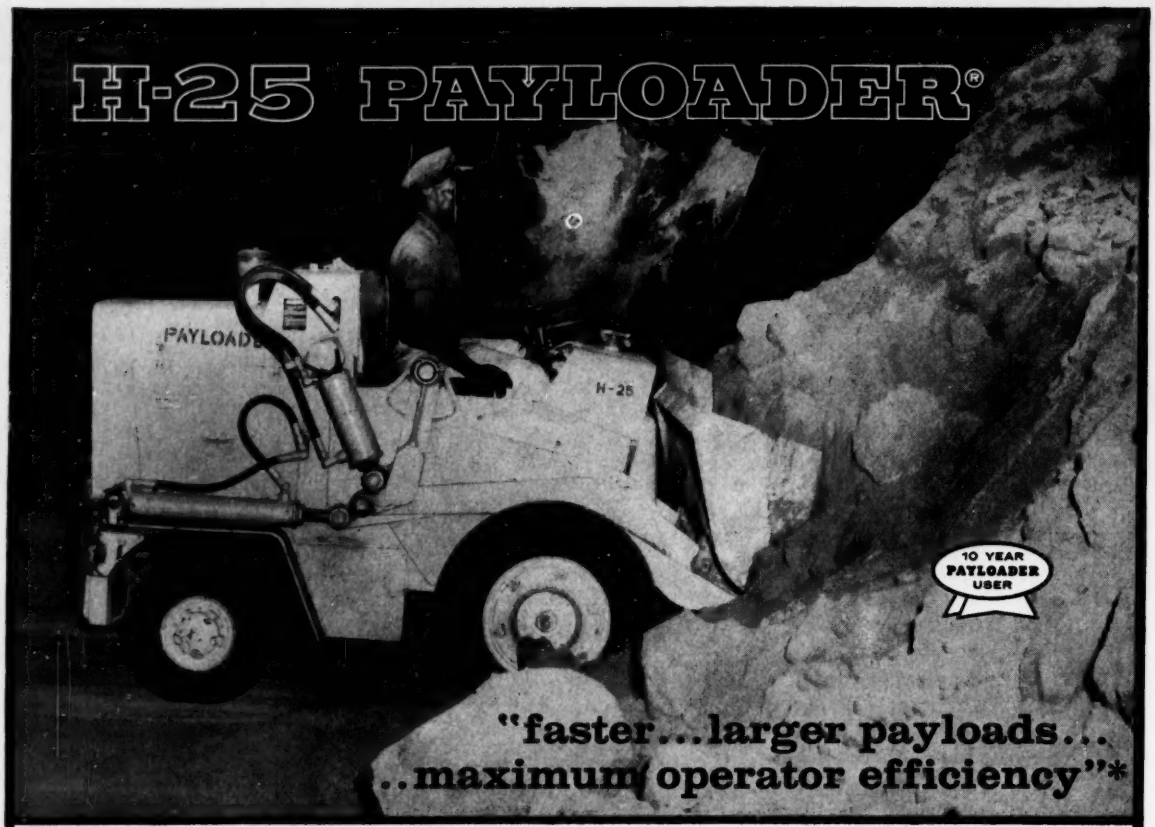
Materials: steel, semi-steel, Ni-resist, carbon steel, bronze, aluminum.

Sizes: ½" through 30".

Working Pressures: 125 through 800 pounds.

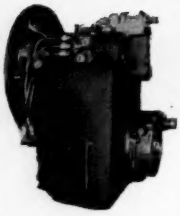
8910

H-25 PAYLOADER®



"faster...larger payloads... ..maximum operator efficiency"*

Exclusive..



Complete power-shift transmission

. . . the only tractor-shovel in its size range with full power-shift transmission having two speeds forward and two reverse . . . the low range for digging power and close maneuvering . . . the high range for fast, economical travel in either direction.

*"We have been using 'PAYLOADER' units for some 10 years with very satisfactory service. Our latest, the H-25, is doing an all-around better production job. It is faster, carries larger payloads and we get maximum operator efficiency because of less operator fatigue", says J. E. Dorland, Mgr. McMillan & Harrison Fertilizer Co., Mobile, Ala.

BUILT-IN MANEUVERABILITY AND SPEED

The Model H-25 with 2500 lb. carry capacity, only 6 ft. turning radius, power-shift and easy power-steering is the most concentrated package of tractor-shovel ever designed. "No-spin" differential and 4500 lbs. of bucket breakout force are two other reasons for the outstanding traction and digging power of this superior tractor-shovel.

LOWER MAINTENANCE — LONGER LIFE

The boom and bucket mechanism is rugged and simple with fewer parts and linkages and with anti-friction bearings at critical pivot points. Triple air cleaning for the engine, cartridge-type filters on all three oil systems, self-adjusting sealed hydraulic brakes and special grease and oil seals at all pivots and ball joints all contribute to long life and low maintenance.

Ask your Hough Distributor to prove the H-25 on your work. Ask him, too, about larger models in the "PAYLOADER" line.

THE FRANK G. HOUGH CO.
754 Sunnyside Ave., Libertyville, Ill.

_____ Send H-25 "PAYLOADER" data
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Title
Company
Street
City State

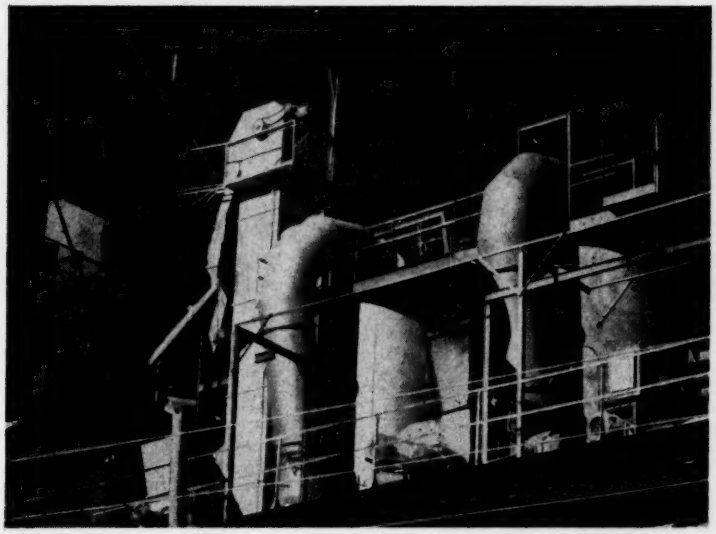
9-A-1

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

SILICONE NEWS from Dow Corning

Found: A Paint that Lasts



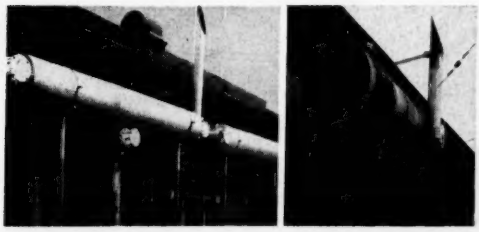
Cut Costs with New Long-Lived Silicone Finishes

You paint your plant to protect against rust and rot, but how can you protect the paint? Sun, rain, heat, sleet, smoke, and other elements of the industrial climate take a heavy toll. Shortly after the paint is completely dry, it starts to deteriorate. Soon, it must be re-applied. Thus, the cost of keeping away rust can run high: not due to the price of the coating material as much as to the repainting time involved.

Now, however, new paints based on silicone resins make it possible for you to make some really substantial cuts in paint maintenance costs. Proven to have superior durability, these silicone finishes last a good 25% to 100% longer. They keep their gloss and color and film integrity despite tough exposure to weather . . . despite high temperatures that burn or crack conventional finishes.

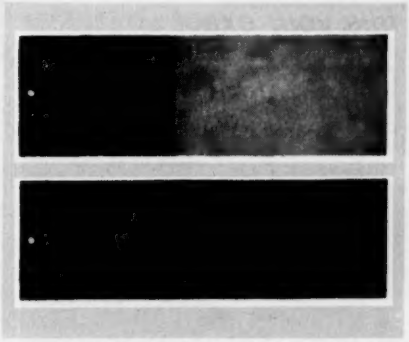
Naturally, this greater staying power means fewer repainting jobs. And that's especially important in hard-to-get-at areas of the plant, or on hot-running equipment that must be shut down for painting.

For instance, the Austin White Lime Company, of Austin, Texas, had difficulty keeping paint on the kilns and stacks shown above. Then they tried a paint based on Dow Corning Silicones, and report it ". . . by far the most satisfactory paint we have ever used." You can see the gleaming results.



Many other firms have come to the same conclusion. At left are two diesel mufflers at the Philadelphia Gas Works. Both were painted two years before these pictures were taken; one with an organic coating, the other with a silicone finish. The burned, cracked and discolored paint is the organic; the "like-new" coating is the silicone.

What if there's no heat problem, just weathering? New silicone-based coatings outlast conventional paints even where high temperatures are no problem. Look at the test panels in the photo. These panels have been exposed for one year in an industrial location where corrosive atmospheres frequently prevail. The conventional organic paint has faded, lost its gloss and chalked badly, while the silicone finish (bottom) is still in fine shape.



Colors Unlimited . . . Silicone finishes run the complete spectrum. If you want a hot-spot finish that will resist 1,000 F, certain pigments such as aluminum must be used.

But, when temperatures are not high enough to damage the pigment, you can get virtually any color you wish. This is important, for it means that, for the first time, you can carry color-coding systems over onto hot equipment without worrying about early paint failures.

Product finishes based on Dow Corning Silicones further prove the resistance to chalking, checking, fading and oxidation of these resins. For example: Sherer-Gillett, Marshall, Mich., a major producer of refrigerator display cases for supermarkets, has found a silicone-based enamel superior in durability . . . retaining high gloss after long wear . . . capable of absorbing more abuse.

Why not investigate silicone paints for your plant? Send today for the descriptive brochure, "Why Silicone-Based Paints Mean Less Maintenance." Write Dept. 2621.

Your nearest Dow Corning office is your number one source for latest information and technical service on silicones.

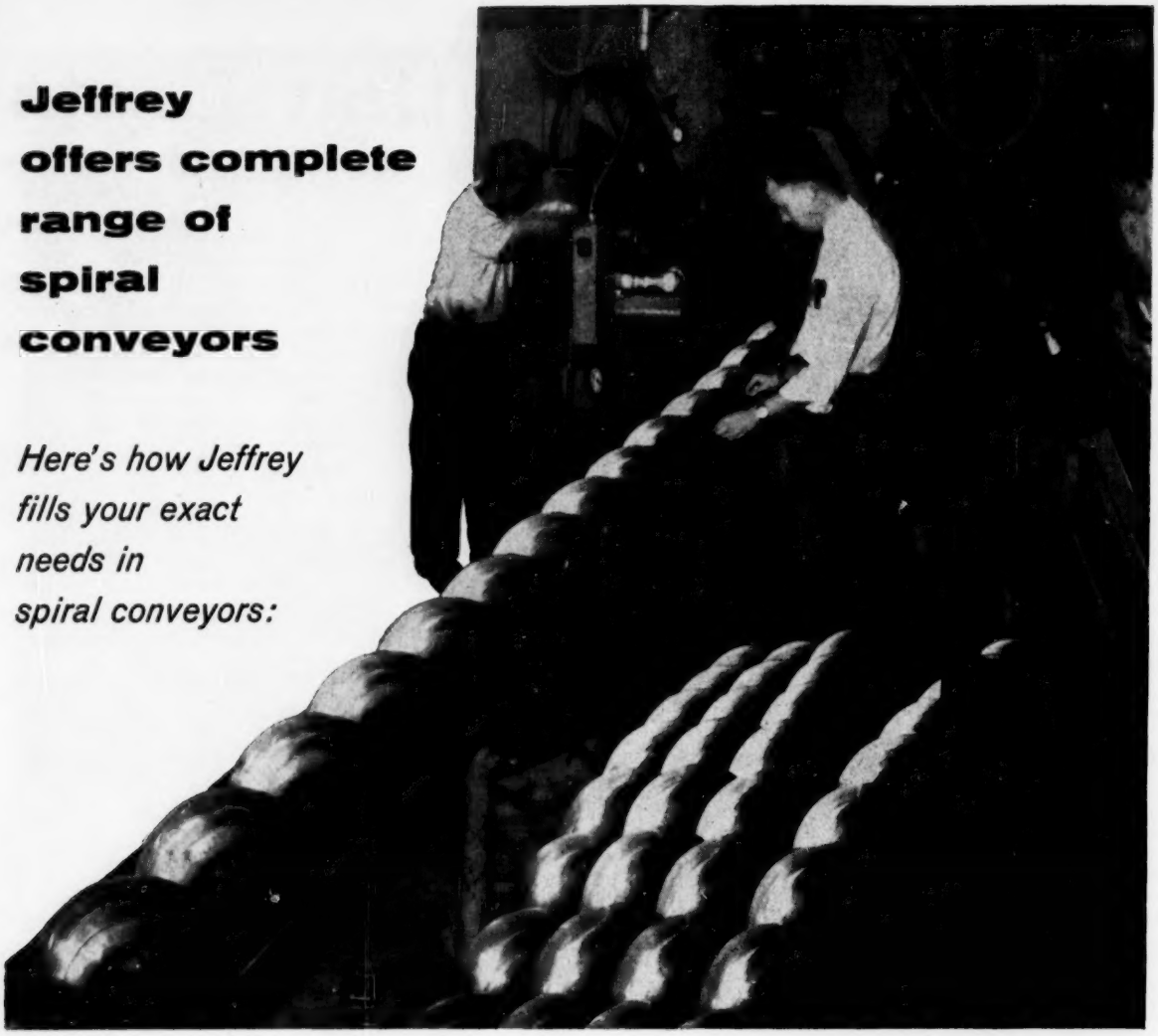
first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Jeffrey offers complete range of spiral conveyors

Here's how Jeffrey fills your exact needs in spiral conveyors:



- Complete range of types—sectional spirals, ribbon conveyors, cut flight conveyors, short pitch conveyors, double flight conveyors—all in a wide range of diameters and thicknesses.
- Stock is maintained on all widely used types, permitting Jeffrey to make fast shipment.

Standard conveyors are made in mild or abrasive resistant steels. Where heat-resistance or corrosion-resistance is required, you can select Jeffrey spirals in stainless steel, brass, Monel, aluminum, or other special metals.

With Jeffrey spiral conveyors you get a complete selection *plus* extras in quality—precision fit, smooth flight surfaces and non-toxic protective coating. For full information write for Catalog 951. The Jeffrey Manufacturing Company, 909 North Fourth Street, Columbus 16, Ohio.

Centrifuge cake ranging from 62 to 67 per cent solids are transferred to a mixer by a 16" diameter Jeffrey Spiral Conveyor at the lime reclaiming plant of the City of Lansing, Michigan.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

New Aluminum Fittings

Added to Killark Line

EXPLOSION-PROOF MOTOR STARTER ENCLOSURES

Designed for your next job calling for motor control equipment. Guaranteed to please you. Made of popular lightweight cast alumalloy—strong and carefully machined for ease of operation and long, trouble-free service. We'll include starter of your choice.

XMS SERIES STARTER

Designed to incorporate standard magnetic across-the-line starter equipment including sizes 0, 1, 1½, 2, 3, 4 and 5.

XMCS SERIES COMBINATION STARTER

Available with starters 0 through 5 with protective circuit breaker or disconnect as required.

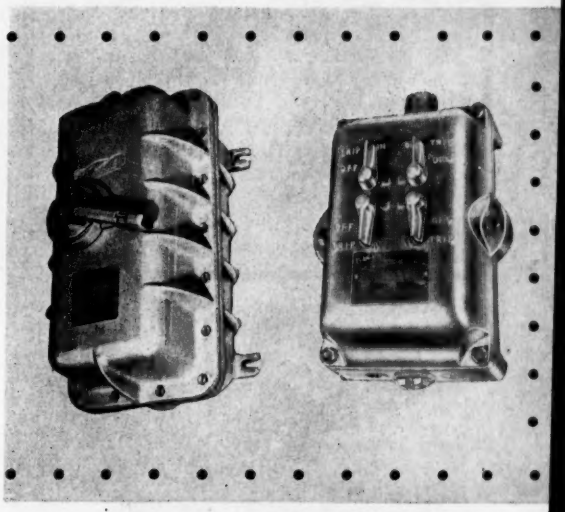
EXPLOSION-PROOF CIRCUIT BREAKER ENCLOSURES

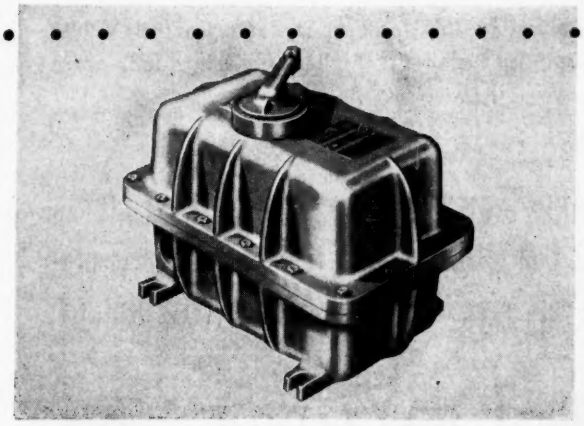
Complete line includes dust-tight and weather-proof as well as explosion-proof breakers. Modern, lightweight cast aluminum. All sizes through "LM" Frame. Easy-action handle assembly for smooth, positive operation. Breakers included.

Modern, lightweight cast aluminum housing that requires no maintenance and meets the most exacting installation needs.

XCB Series Breaker Enclosures—All sizes complete through "LM" Frame. We include breakers. Easy-action handle assures smooth, positive operation. Lockout included.

XPCB Series Breaker Enclosures—Will accommodate 4 single pole "quicklag" type breakers, or 2 double pole, or 1 three pole, or any combination not exceeding 4 poles. Amp. ratings through 70 amp.





EXPLOSION-PROOF DISCONNECT SWITCHES

A long-felt need in the electrical industry will be filled by this complete line of disconnect switches (Series XDS). They are available with or without solid neutral, fuseable and non-fuseable, all with convenient mounting lugs. Constructed of lightweight, non-rusting, non-corroding aluminum, they offer a full range of hub arrangements and conduit sizes.

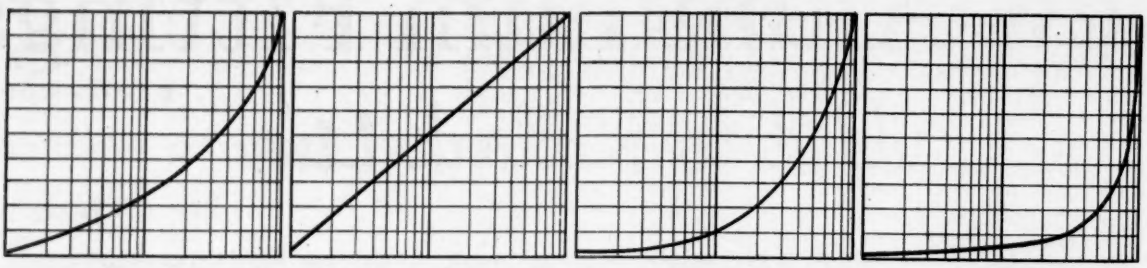
WE WOULD APPRECIATE THE OPPORTUNITY OF BIDDING ON YOUR NEXT JOB

K KILLARK ST. LOUIS

Killark

ELECTRIC MANUFACTURING CO.

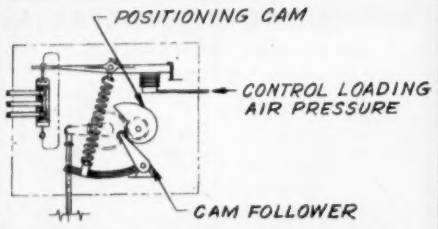
Vandeventer and Easton Aves. St. Louis 13, Mo.



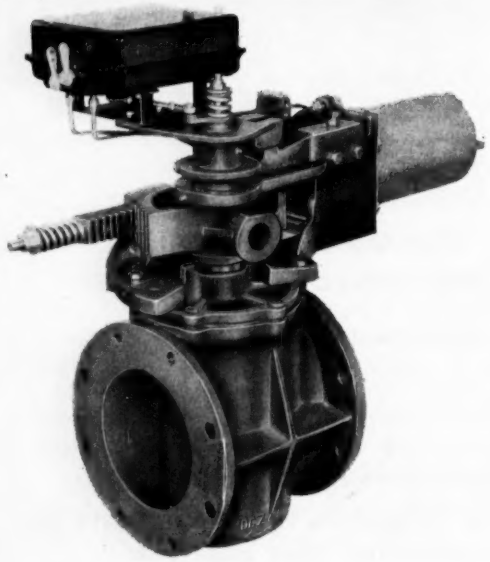
TAKE YOUR CHOICE!

ANY OF THESE (and many more) CHARACTERISTICS ARE OBTAINABLE with DeZurik CONTROL VALVES

WITHOUT DISMANTLING THE VALVE!



The positioning cam in the positioner is easily changed to vary the throttling characteristic. Cams can be supplied to produce virtually any desired curve, or they can be cut "on the job" to produce a characteristic tailored to the installation.



DeZurik Control Valves present an endless variety of possibilities to the instrument engineer. The characterizing feature of the positioner allows various positioning cams to be used which will produce almost any desired throttling characteristic.

The throttling characteristic may be preselected and the proper cam supplied with the valve from the factory, or the cam shape and resultant flow curve may be determined after installation of the valve. Changing cams is a simple operation and does not involve changing any valve part.

DeZurik Control Valves have extremely high rangeability, providing a wider control range than is available with ordinary control valves. Because of the port design and eccentric action, the flow characteristic is useable down to the shut off position.

In addition to this feature, DeZurik Control Valves offer dead-tight shut-off, higher capacity, leak-proof rotary stem seals, straight-thru flow and many other desirable features.

AVAILABLE NOW! GET THE COMPLETE STORY on DeZurik Control Valves. Ask the DeZurik representative in your area for Bulletin 150, or write Dept. CV.

DeZURIK CORPORATION
SARTELL, MINNESOTA

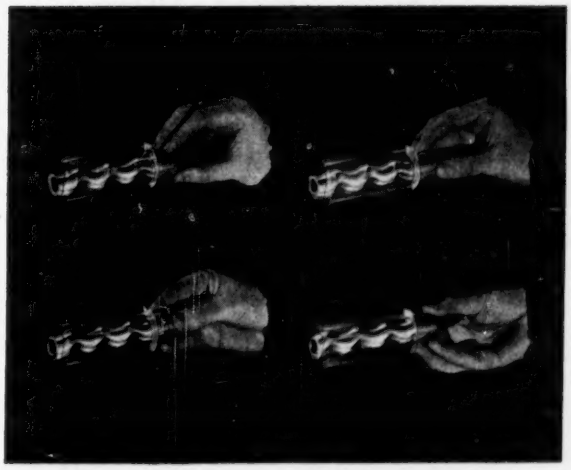
MOYNO®
CHEMICAL PUMPS

MOYNO® Progressing Cavity Pumps Handle Chemicals that *Ruin Other Pumps!*

MOYNO's unique *"progressing cavity"* principle and special resistant internal parts slash pump maintenance costs on problem chemicals that ruin other pumps. Any chemical that can be forced through a pipe—from thin watery slurry to extremely viscous rubber dough—can be pumped with a MOYNO.

As illustrated at right and in the cutaway model above, a rugged screw-like rotor turning inside a double-threaded stator forms *"progressing cavities"* which move chemicals smoothly. Fluids are pumped without turbulence, agitation or pulsation, and discharged uniformly. Rotor and stator materials resist abrasion and corrosion. Hundreds of difficult chemicals successfully handled prove that MOYNOS show little wear, even after long service. They have increased production and greatly lowered downtime on many jobs where they replaced other type pumps which had run up prohibitive maintenance costs or failed completely. On other jobs, MOYNOS have succeeded where chemicals were formerly moved by hand or other expensive means because they were considered unpumpable.

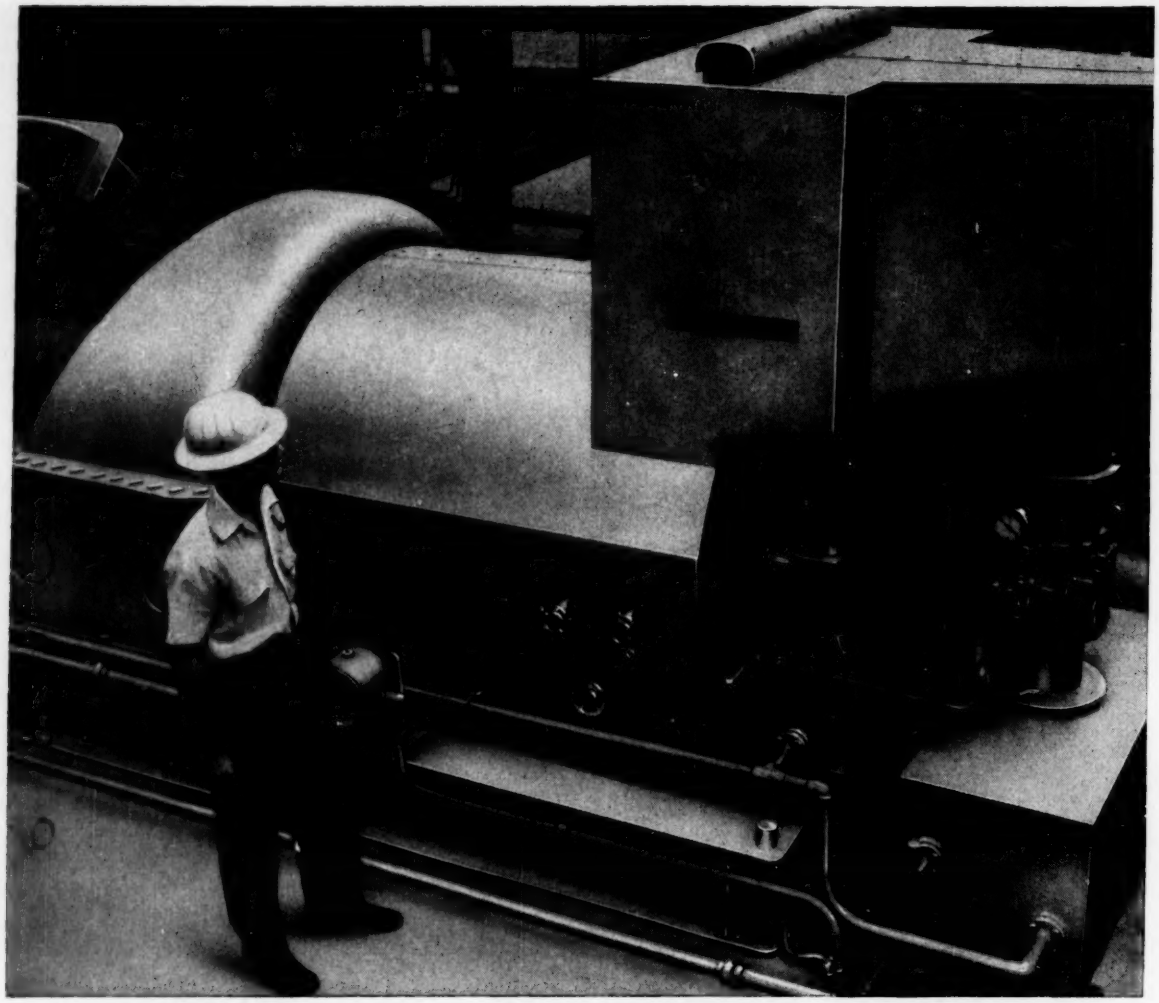
MOYNOS are available in capacities up to 500 gpm; pressures up to 1000 psi. Off-the-shelf replacement parts are always immediately available. To find out how you can decrease chemical pumping costs, write today for Bulletin 40 CE



ROBBINS & MYERS, INC.

motors, household fans, Propellair industrial fans, hoists, Moyno industrial pumps

SPRINGFIELD, OHIO · BRANTFORD, ONTARIO



Westinghouse multi-stage, hi-speed turbines guarantee you

...engineered power to meet your exact needs

Why pay for power you can't use? Or, by the same token, why strain a machine beyond its capability? Westinghouse can meet your exact turbine requirements with the world's broadest line of wheel sizes and design capabilities for steam conditions through 2400 psig—1050° F at the throttle, exhausting from 1 in.hg absolute to 300 psig.*

Fitting the right wheel size to the job is the key to efficiency and economy. By knowing your process requirements, cost of steam and number of hours you expect your turbine to run during the "payoff" period, we can provide the turbine design best suited to your power and economic requirements.

To meet these varied requirements, Westinghouse has available five frame sizes of multi-stage, hi-speed turbines with wheel diameters ranging from 12 in. to 32 in. In addition, interchangeability of many wearing parts saves you money on inventories and stocking of spare parts.

Westinghouse turbine specialists located throughout the country are available at all times to provide personal attention to your heat balance problems, and are equipped to offer on-the-spot price and performance data for this entire turbine line. The capabilities of the world's largest and most modern small turbine facility are at your disposal. Call your Westinghouse representative, or write Westinghouse Electric Corporation, Small Turbine Sales, Lester Branch Post Office, Philadelphia 13, Pennsylvania. J-50605

***WESTINGHOUSE MULTI-STAGE, MULTI-VALVE, HI-SPEED TURBINE FRAME CAPABILITIES**

Turbine Frame	M-12	M-16	M-20	M-25	M-32
Number of Stages	.....	.....	As Required	.....	.....
Wheel Size, in.	12½	16	20	25	32
Maximum hp	4000	5000	7000	10,000	16,000
Maximum rpm	16,000	12,500	10,000	8000	6000
Maximum P_1, psig	1500	1500	1500	1500	1500
Maximum T_1, °F/T	950	950	950	950	950
Maximum P_2, psig	300	300	300	300	50
Exhaust Size, in.	20	24	30	36	48
D. F. Exh. Size, in.	30	36	48	42 x 64½	48 x 84
Max. Inlet Size, in.	5	6	8	10	12

(For special applications, inlet steam conditions to 2400 psig, 1050° F total temperature can be accommodated.)

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

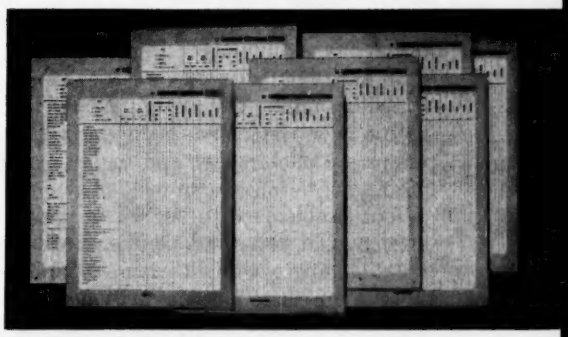
Now you can predict service life because Byers PVC Pipe Engineering brings a factual approach to piping system design

FACT: 400 corrosion resistance ratings are available for Byers PVC Pipe

The ability of Byers PVC Pipe to handle various corrosive media is down in black and white. There are a number of tables available from Byers Engineering Service Department listing corrosion resistance ratings. Actual laboratory tests helped to determine these ratings. And we present them on a comparative basis with several metallic pipe materials.

Since ratings appear only for 72°F and 140°F, these tables do not show all applicable ranges for Byers PVC Pipe. So if applications arise where you need more information, at a specific temperature and concentration, check with us.

Remember—as in metals—concentration, temperatures and stress influence corrosion rates of PVC. Type I PVC displays considerably greater corrosion resistance than Type II, which is best where high impact resistance is the prime consideration. More of this story is available from the Byers field service representative. Call him, soon. **A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.**

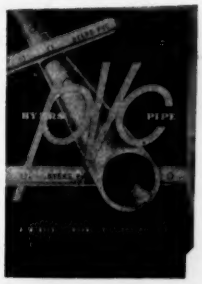


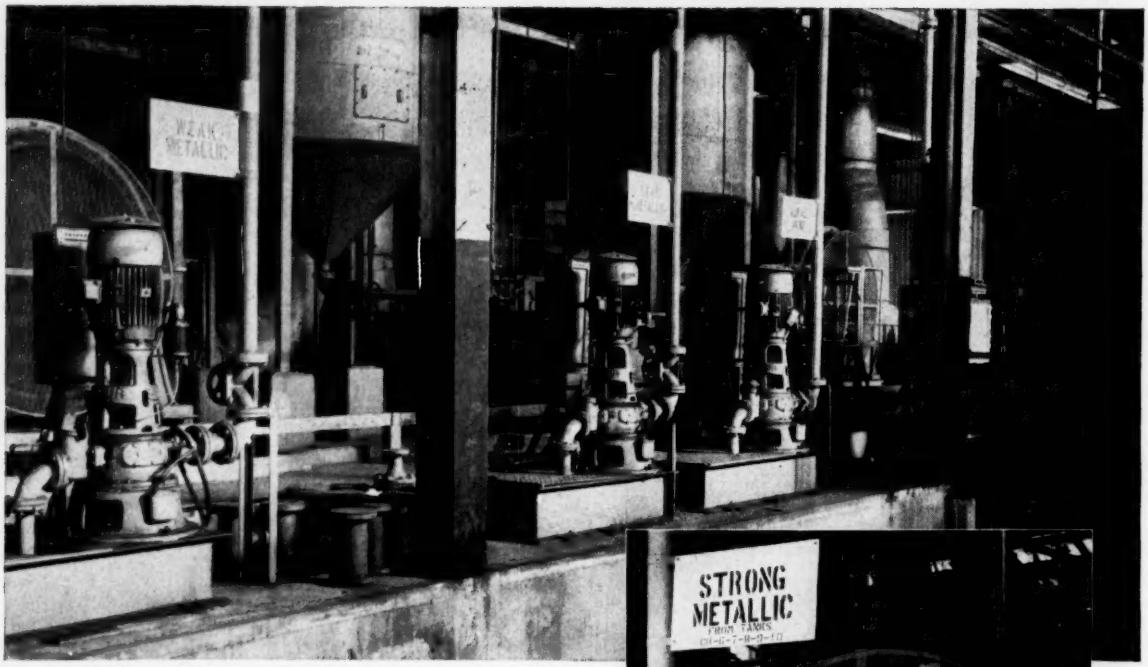
Resistance ratings are divided into four categories: E for excellent, G for good, L for limited, and U for unsatisfactory. In applications where PVC is rated as "good" and "limited" it will still display considerable resistance, in most cases higher than that of metal pipe materials.

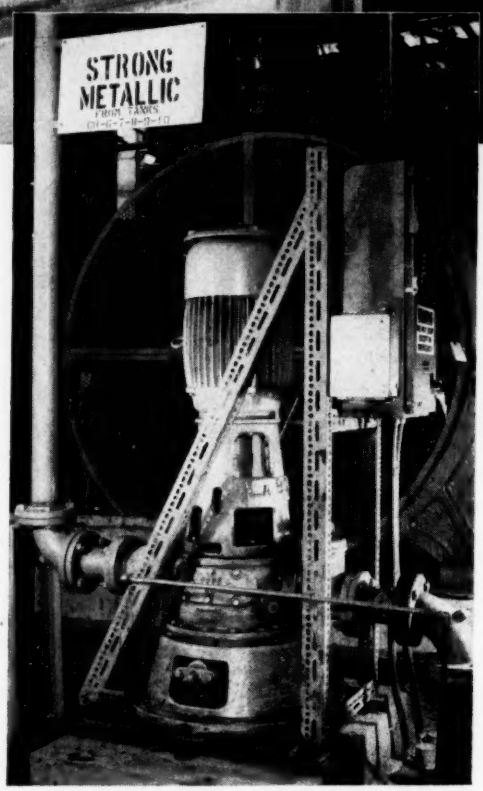
BYERS PVC PIPE

ALSO SHEET AND ROD STOCK

Write our Engineering Service Department for copy of this new 32-page illustrated catalog on Byers PVC Pipe.







Daily Job:

Move a Million Gallons of Corrosive Liquids

Industrial waste treatment at this large automotive manufacturing plant calls for neutralizing 1,500 gallons of noxious solutions per minute. Some 150 LaBour pumps handle the cyanide, metallic acids, alkali and other corrosive liquids involved in cleaning and plating operations. Every day more than a million gallons of such liquids are pumped.

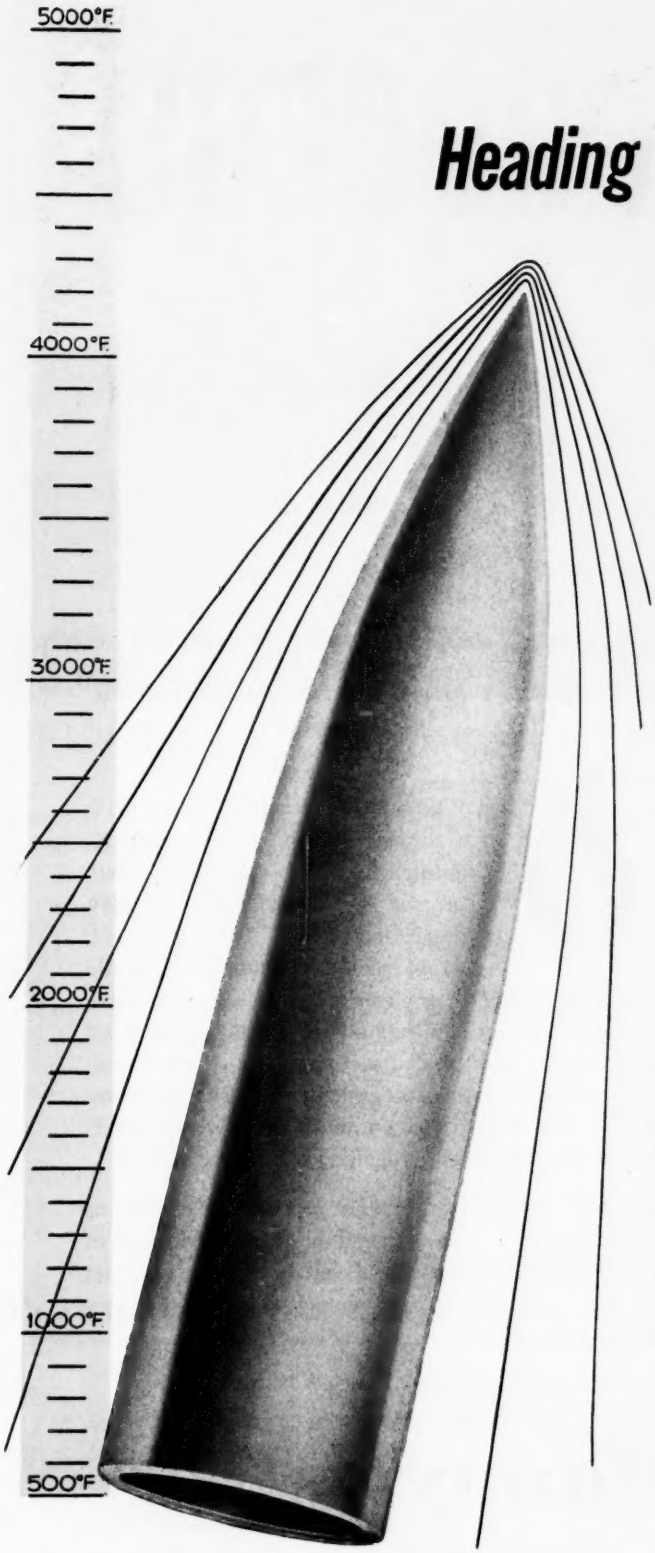
Highly satisfactory performance of the LaBour pumps is reported by the operating staff. The pumps are packingless, and maintenance is at a minimum.

Your problems with corrosive liquids may be different, but you can depend on LaBour to solve them. Competent application advice is yours for the asking. Write us today.

ORIGINAL MANUFACTURERS OF THE SELF PRIMING CENTRIFUGAL PUMP

LABOUR

THE LaBOUR COMPANY, INC. • ELKHART, INDIANA, U. S. A.



Heading for the unknown?

Check your processing requirements against Norton Fused Zirconia

You can't predict tomorrow's processing requirements. However, you can be prepared to meet many of them more efficiently and economically . . . with Norton *Lime-Stabilized* Fused Zirconia.

Consider Its Unusual Characteristics

Extremely high melting point (4,620°F) coupled with a lower thermal conductivity than standard dense refractories • Excellent resistance to thermal shock and abrasion • Not wet by most metals • Moderate electrical insulator at low temperatures and conductor above 2,200°F • Good stability in either oxidizing or reducing atmospheres.

Consider Its Many Applications

As potential material for use in missiles and reaction motors • As a support for firing highly-reactive titanates • As lining for furnaces containing high temperature gaseous reactions • For furnace parts and linings used in the metals industry • As lining and packing media for high temperature air heaters and heat exchangers • For many other critical processes.

Chances are you can improve both your processing and your production economy with this rugged, versatile material. Let a Norton Sales Engineer help. He's well qualified to discuss your precise requirements. Write to NORTON COMPANY, Refractories Division, 509 New Bond Street, Worcester 6, Mass.

Note: Norton *Lime-Free* Fused Zirconia is also available for the manufacture of refractories, as a source material for zirconium for chemicals and metals, or as an opacifier for glazes and enamels.

Melting Point	4,620°F
Maximum Usable Temperature	4,450°F
Chemical Nature	Stable
Electrical Resistivity	High Temperature Conductor
True Specific Gravity	5.6 — 5.7
Two Grain Types	Hard Dense Grains Bubble-Type Grains

NORTON
REFRACTORIES
Engineered . . . Rx . . . Prescribed

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

is your PROCESS FLOW HOT?

Honeywell control valves are available for a wide range of temperatures

Whether you're talking about 1200 or minus 450° F, there's a Honeywell automatic control valve for your process flow. The Honeywell valve illustrated—Series 800, Type 11 double seated—is designed to handle fluids at 1200° F. This application requires such features as: welded-in, solid stellite guide bushings . . . stellited guide posts . . . seal-welded seat rings . . . spiral wound, asbestos-filled, stainless steel gaskets . . . high-temperature bolting . . . extended bonnet with fins . . . designed clearances for non-sticking, non-galling operation.

For hot or cold flows . . . or other process flow conditions . . . Honeywell valves are available in a wide range of types and sizes. When you need control valves . . . contact your local Honeywell field engineer. Write for new Catalog C800-1.

MINNEAPOLIS-HONEYWELL, Fort Washington, Pa.

Honeywell

H HONEYWELL *First in Control*

produced by thermal decomposition

Disappointed with conventional magnesium oxides? Then try International's. *It's the only MgO produced by thermal decomposition.* And the difference is amazing! Electrically furnaced, this MgO has achieved the highest resistivity and refractory properties of any commercially available magnesium oxide.

You'll find International MgO relatively low in cost. Now improved production facilities are geared to produce any quantity you need.

For further details, fill out and mail the coupon . . . you can count on a prompt reply.

Here's how IMC does it!

CONVENTIONAL PROCESSES

↓

Magnesium Chloride $MgCl_2$
(Contained in sea water, well brine, bittern.)

+

Lime CaO
(Contained in dolomite, sea shells, etc.)

↓

Magnesium Hydroxide $Mg(OH)_2$ + heat

↓

Magnesium Oxide MgO

INTERNATIONAL'S UNPARALLELED PROCESS

Magnesium Chloride $MgCl_2$ + heat

↓

Magnesium Oxide + Hydrochloric Acid
MgO HCl

↓

heat → MgO

And here's the result!

MgO	99.5%	Cl	0.03	Density .... 75 lbs./cu. ft.
SiO_2	Nil	CaO	0.05	Low Boron, too,
SO_4	0.03	Fe_2O_3	0.05	upon request!

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Administrative Center: Skokie, Ill. • Phone ORchard 6-3000 • 485 Lexington Ave., New York 17 • Midland, Texas

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POTASH INDUSTRIAL • Skokie, Illinois

This coupon will bring you complete descriptive data and specifications, plus a sample of (check one) . . .

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Name .....
Firm .....
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41-59

Accurate, reliable temperature control need not be expensive

By John W. Ritter, Test Engineer
Sarco Company, Inc.

Temperature regulation equipment for food processing should be simple to use and easy to maintain. It should be absolutely reliable for the protection of the product—and inexpensive enough to use economically.

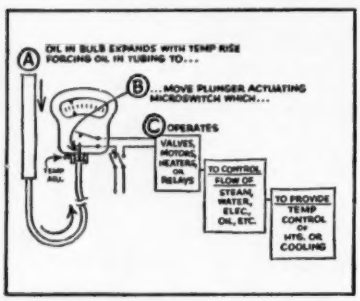
The satisfaction of these multiple demands is a matter of selecting controls that match the job, buying only the amount of control you need and no more.

A very good solution to this problem is the specification of a Sarco Electric Indicating Control. This type of control allows you a wide selection of ranges and adjustment within those ranges for your exact operating conditions.

The same unit can be used for controlling steam, water, or electricity and will regulate heating or cooling or both.

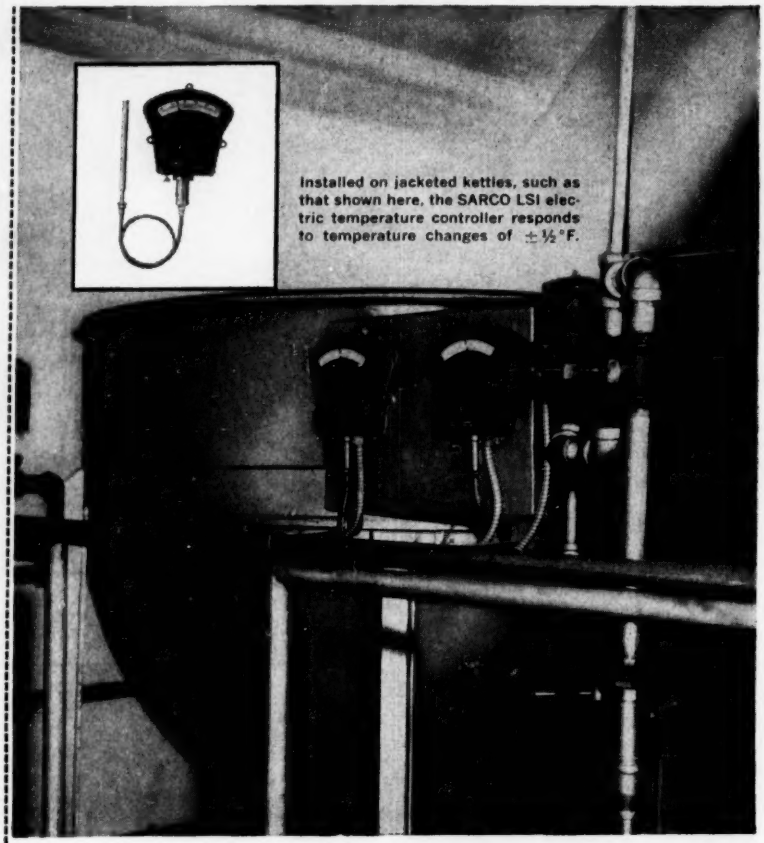
For additional flexibility in controlling heating or cooling, various interval timers and other control devices can be incorporated with Sarco Electric Indicating Temperature Regulators.

Sarco Electric Indicating Temperature Regulators include large easy-to-read dials with both actual and set temperatures on one scale, graduated in regular, even increments.


A
OIL IN BULB EXPANDS WITH TEMP RISE FORCING OIL IN TUBING TO...
B
...MOVE PLUNGER ACTUATING MICROSWITCH WHICH...
C
OPERATES
VALVES, MOTORS, HEATERS, OR RELAYS
TO CONTROL FLOW OF STEAM, WATER, ELEC., OIL, ETC.
TO PROVIDE TEMP CONTROL OF HTG. OR COOLING

This rough sketch shows how the Sarco LSI Electric Indicating Temperature Control can be used to actuate valves or relays, control flow or provide temperature control for heating or cooling.

In addition to simplicity and reliability, the Sarco control can be quite easily maintained by the regular maintenance crew, and its installation is a simple and inexpensive job.



Installed on jacketed kettles, such as that shown here, the SARCO LSI electric temperature controller responds to temperature changes of ±½°F.

You get the sensitivity you need—
in the range you need—with
reliable SARCO Electric Indicating Regulators

The installed cost of Sarco Electric Indicating Temperature Controllers is low, and they are inexpensive to maintain. They provide the sensitivity you need over the temperature range of *your* process. You get response to temperature changes of ±½°F. You change control setings simply by turning one knob. You get a continuous visual check on process temperature by reading both set and actual temperature on one large scale.

Sarco Electric Indicating Temperature Controllers are available for temperatures from 90°F. to 650°F., in operating ranges from 100°F. to 400°F. In addition, they offer many switch sequence combinations, such as step-heating, heating and cooling, and temperature control with the operation of visual or sound signaling devices.

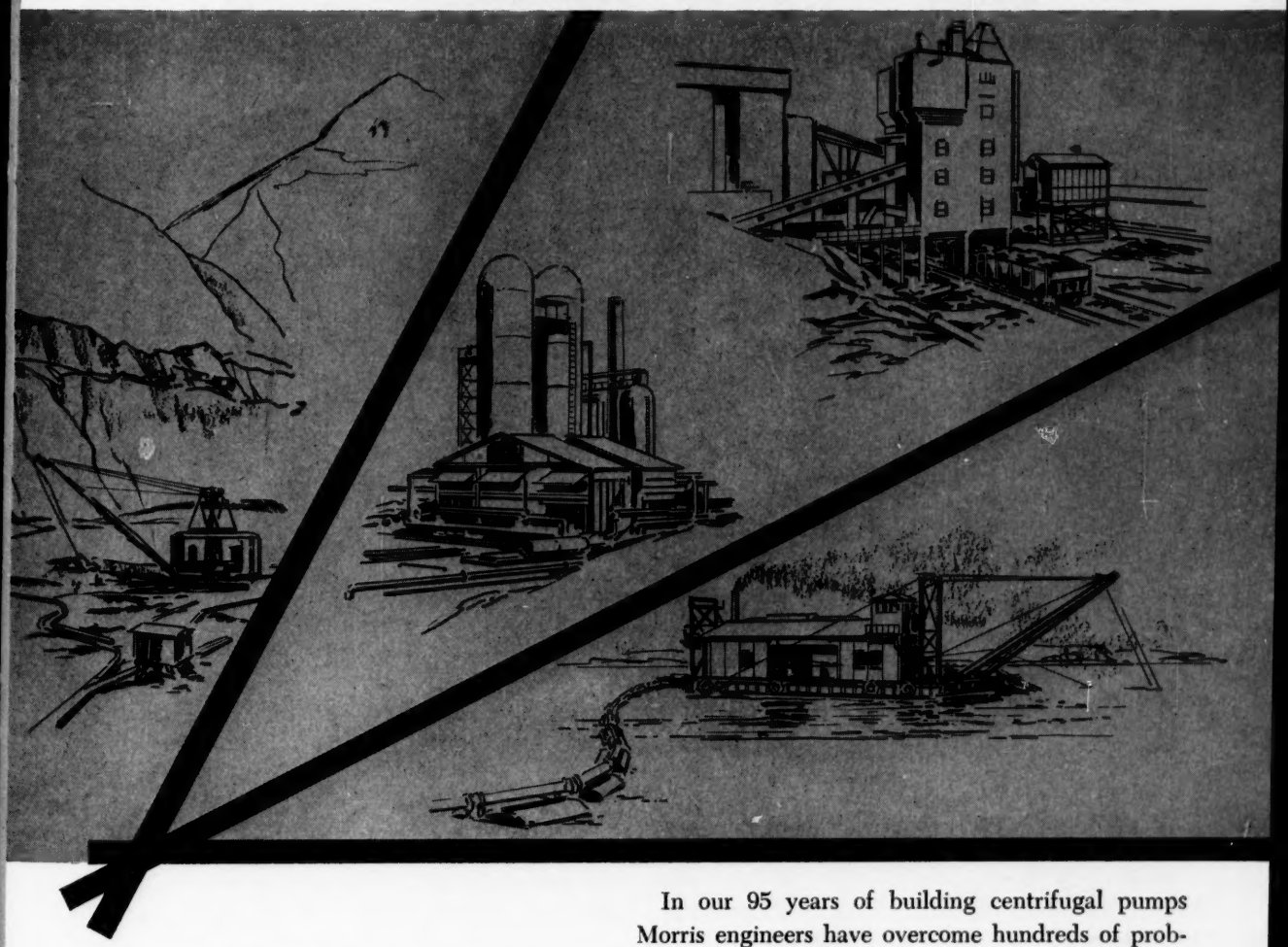
Write today for our latest bulletin on Sarco Electric Indicating Controls. 6928-B

SARCO
COMPANY, INC.
635 Madison Ave., New York 22, N. Y.

TEMPERATURE CONTROLLERS • STRAINERS • STEAM TRAPS • HEATING SPECIALTIES

Where DEPENDABILITY counts in centrifugal pumps...

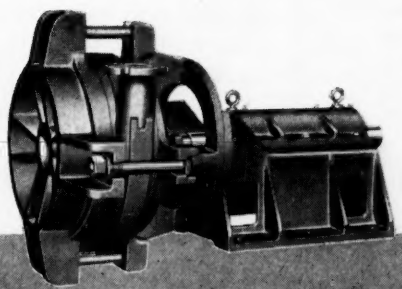
(and where doesn't it?)



more and more users depend upon MORRIS

In our 95 years of building centrifugal pumps Morris engineers have overcome hundreds of problems caused by the substances being pumped or by the required speeds, heads, maintenance, and other factors. Elements such as these and their handling under specific conditions are taken into consideration in *every* Morris pump supplied you.

Morris pump dependability relies, of course, on the usual factors of metallurgy, design and precision manufacture. But it also stems from the broader base of balancing the working parts of the pump against the conditions under which it must operate. You, the user, reap the full benefit of — *Greater Dependability.*



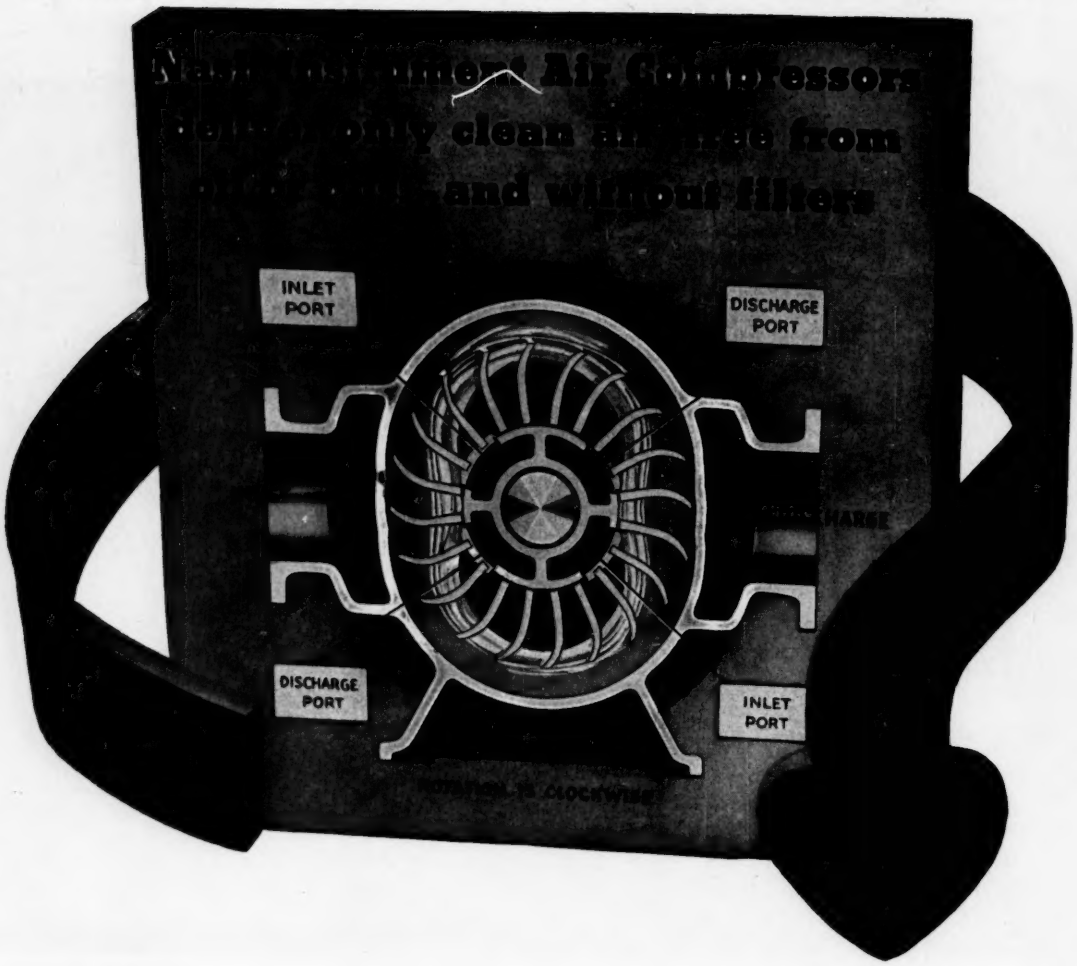
Type-RX Slurry Pump. A heavy duty, low speed slurry pump expressly designed to to handle abrasive slurries up to the maximum fluid consistency, under suction lift or positive head.

- Let a specially trained Morris sales engineer help you select the "just right" pump for your job.

MORRIS CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS • Baldwinsville, N.Y.

SALES OFFICES IN PRINCIPAL CITIES • EXPORT OFFICE: 50 CHURCH ST., NEW YORK 7, N. Y.



Here is Why!

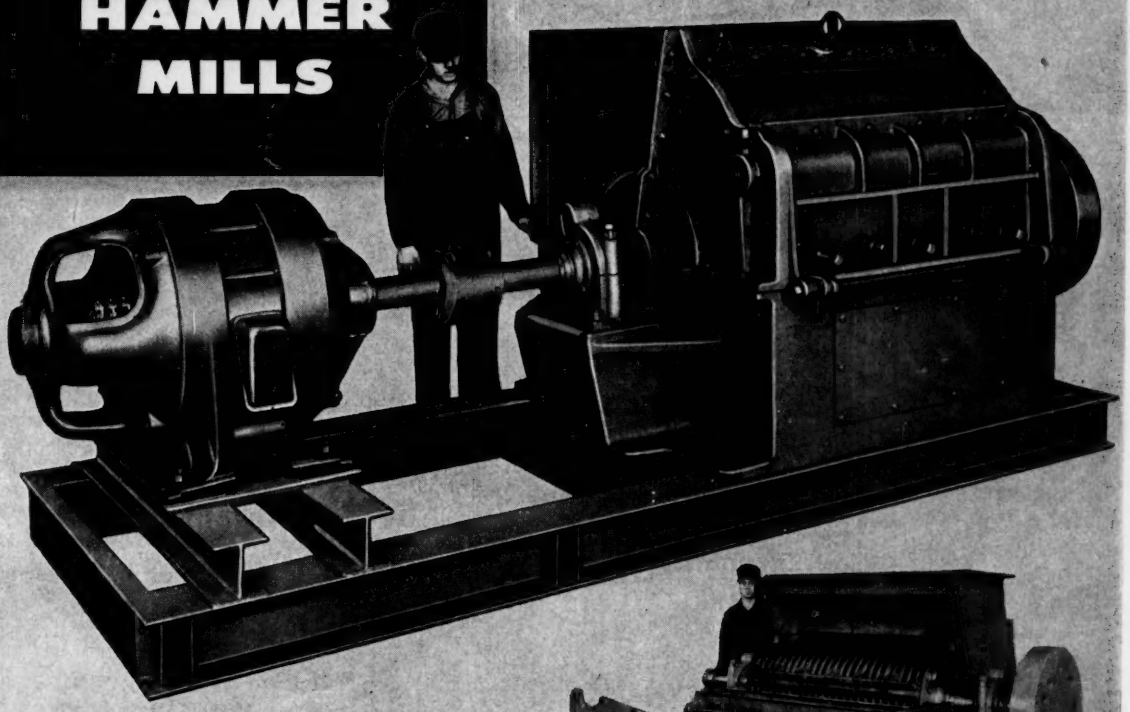
You can dispense with oil filters and dust filters when you install ®Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

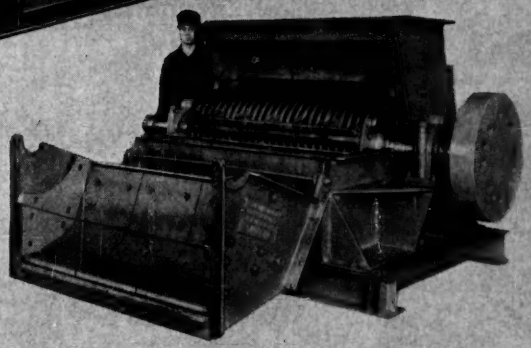
®Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

No oil filters.
No dust filters.
No internal lubrication to contaminate air handled.
No internal wearing parts.
No valves, pistons, or vanes.
Non-pulsating pressure.
Original performance constant over a long pump life.
Low maintenance cost.

NASH ENGINEERING COMPANY
395 WILSON, SO. NORWALK, CONN.

WILLIAMS *heavy duty* HAMMER MILLS





- **Crushes, Grinds, Shreds To Finished Size In One Operation**
- **Reduces Production Costs Up To 50%**
- **Saves Up To 75% On Equipment Cost**

Williams No. 60 GA Mill with heavy duty steel plate frame. Cover has been opened to show heavy duty manganese steel liners, breaker plates, grate bars and hammers.

Whether your size reduction job involves crushing, grinding or shredding—whether the material is mineral, chemical, vegetable or animal—Williams has a hammer mill designed to *do it from start to finish in a single operation.* More uniform product, increased output, plus savings in time and labor can *cut production costs as much as half!*

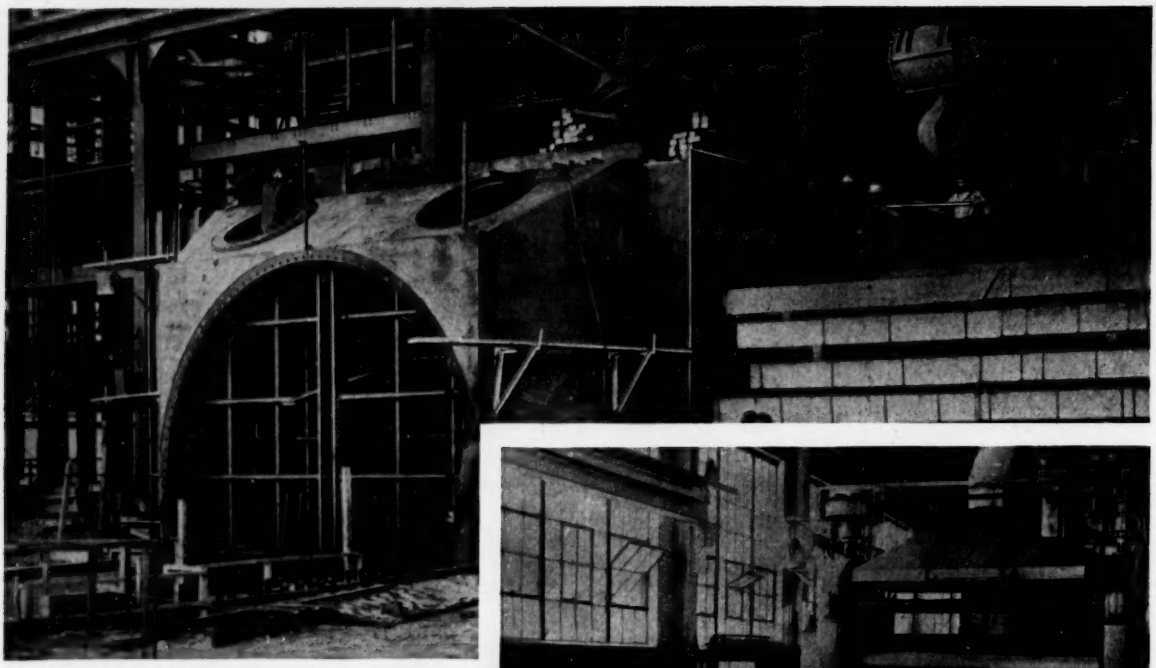
Extra primary and secondary crushers are seldom required with a Williams—no extra drives or conveyors, no costly foundations or buildings for additional crushers are necessary. Expensive maintenance, replacement parts, excessive downtime and labor are reduced to a minimum.

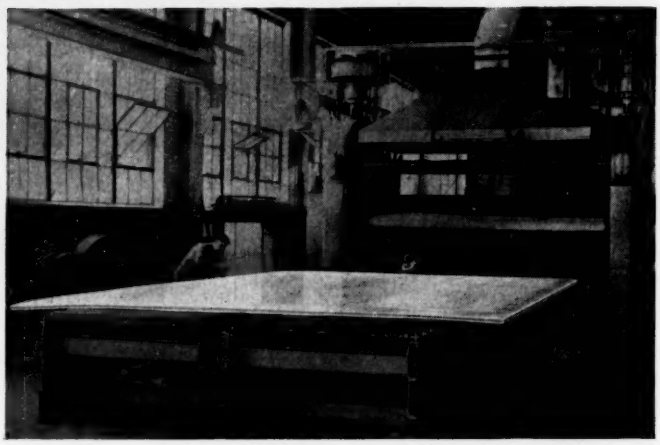
Learn how a Williams hammer mill can step up your output, and improve your product quality. *Write —explain your operation—and ask for a catalog.*

WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. 9th St. St. Louis 6, Mo.

WILLIAMS
CRUSHERS GRINDERS SHREDDERS
Oldest and Largest Manufacturers of Hammer Mills in the World

7-TON COPPER-ALLOY PLATES FOR LARGE SURFACE CONDENSERS





TOP: View of the new Clinch River Plant of Appalachian Power Co., at Carbo, Va. **ABOVE:** Tubing one of the two huge Allis-Chalmers surface condensers. The 26' x 15' openings in the shell use two Anaconda Leaded Muntz Metal-274 plates, each 156" x 189" x 1½" and weighing 13,700 lb. American Brass furnished the eight plates required, as well as the Arsenical Admiralty-439 tubes for the unit above — 19,100 lengths, ⅞" x .049" x 30'. **RIGHT:** The big rolling mill at American Brass Company's Detroit Division which produced the plates.

THE unusually large plates required for the tube sheets at Clinch River Plant are standard items of The American Brass Company, which produces plates of copper and a number of copper alloys in rectangular sizes up to 156 inches in width and 15,000 pounds in weight. The maximum standard limits for circles are 160 inches in diameter and 11,000 pounds in weight. Half circles can be produced up to 13,000 pounds in weight.

ROLLED PLATES SUPERIOR. Anaconda rolled plates are commercially flat, accurate in dimensions, and free from surface imperfections and porosity often prevalent in cast plates.

SPECIAL JOBS. Whenever you have a problem involving extremely large plates in standard or special copper alloys, The American Brass Company will gladly assist in its solution. For general information on Anaconda Condenser Tubes and Plates write for Anaconda Publication B-2: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5956

ANACONDA®

Tubes and Plates for Condensers and Heat Exchangers

MADE BY THE AMERICAN BRASS COMPANY

EC&M *Fuseless* AIR-BREAK STARTER GIVES Certified 100/150 MVA FAULT PROTECTION

NO SINGLE PHASING FROM BLOWN FUSES!

NO COSTLY REPLACEMENT FUSES TO STOCK!

- ✓ Gang-operated Disconnect Switches Grounded for Safety in Open Position. Mechanically Interlocked with Contactor... Never Open Under Load
- ✓ No Fuses. Bus Bars Throughout
- ✓ 3-way Door Interlock. On, Off and Open—with Positive Interlocking between Door, Disconnect and Contactor for Maximum Personnel Protection
- ✓ Heavy-duty DC Operating Magnet. No Chatter—No Hum

FRONT ACCESSIBLE WITHOUT ROLL-OUT!

Phase barrier and arc-chutes slide out. All starter parts exposed and accessible for easy inspection and maintenance

Get the complete story on certified fuseless fault protection for high-voltage motor drives. Write for Bulletin 8130A

THE ELECTRIC CONTROLLER & MFG. CO.
A DIVISION OF THE SQUARE D COMPANY
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2635

FEinc Rotary Vacuum String Discharge Filters at The Hubinger Company, Keokuk, Iowa.

FOR THE HUBINGER COMPANY . . .

STRING DISCHARGE FILTERS *solved the problem*

These FEinc rotary vacuum filters were recently custom built to specifications for The Hubinger Company, Keokuk, Iowa. The job they're doing is a tough one . . . filtering gluten derived from the wet milling of corn.

The string discharge design was selected as the only workable method for cleanly removing the thin, high-protein gluten cake which causes scraper filters to bog down. Each unit has over 500 square feet of filter area.

LOW MOISTURE CAKE CONTENT

Operating continuously, these string discharge filters eliminate blow-back and produce a cake of low moisture content. Stainless steel construction helps maintain product purity according to standards established in over 75 years of starch production.

The FEinc filters in this installation are examples of how custom-made units provide solutions to many difficult continuous filtration problems in the chemical processing industry.

For help with your problem, see our insert in Chemical Engineering Catalog or write today, Dept. CEF-959, for free bulletins and technical advice. Simply state your basic requirements.

For a Bigger Yield

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FILTRATION ENGINEERS

AMERICAN MACHINE AND METALS, INC.

EAST MOLINE ILLINOIS

STRING HORIZONTAL SCRAPER

CUSTOM DESIGNED CONTINUOUS FILTRATION

POWELL
FOR CORROSION RESISTANT VALVES

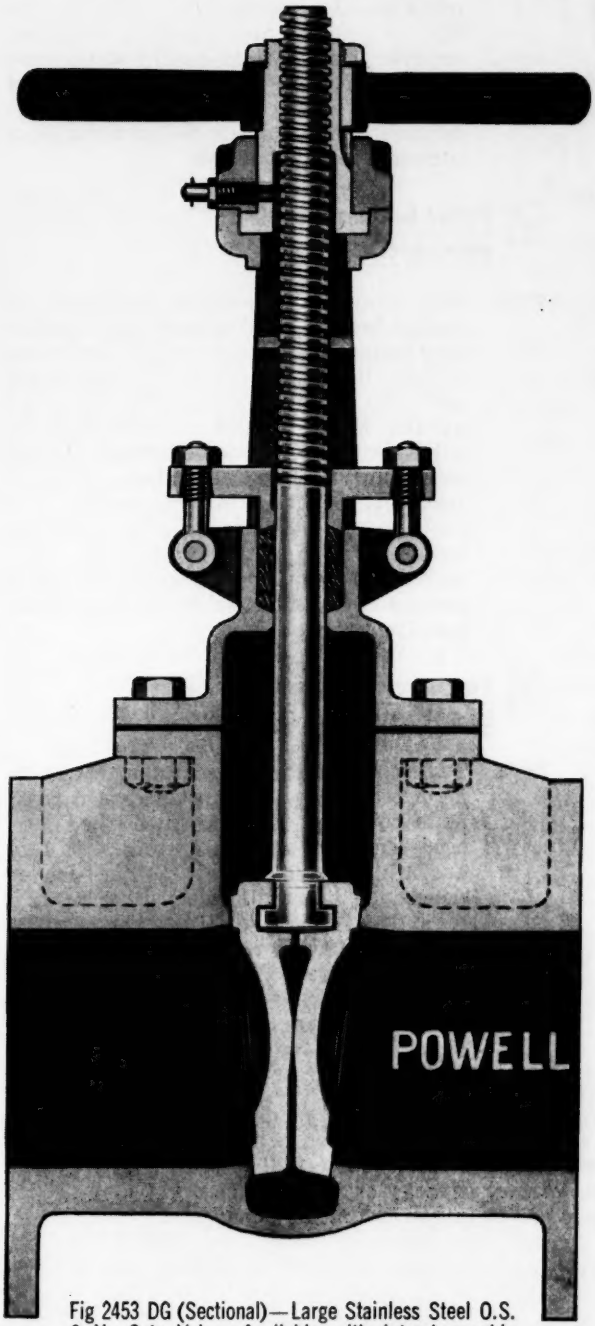

Fig 2453 DG (Sectional)—Large Stainless Steel O.S. & Y., Gate Valve. Available with interchangeable solid or split wedges. Wedges are fully guided throughout their travel.

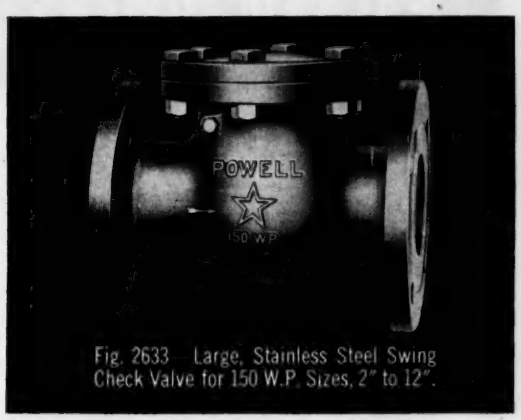

Fig. 2633 Large, Stainless Steel Swing Check Valve for 150 W.P. Sizes, 2" to 12".

Powell offers valves available in the largest selection of metals and alloys to handle practically every corrosive fluid—valves that can be depended upon to control flow in most severe services—because of

Powell advanced design and engineering.

Solid and double wedge discs of gate valves are interchangeable. They are precision machined and fitted, and are accurately guided throughout their entire travel. This prevents drag of the disc over the seat faces, eliminating wear of seating surfaces and stops undue vibrational noises.

O.S. & Y. Valves—Stems are threaded and guided through a bronze bushing in upper yoke. (Bushings made of other alloys can be supplied on special order.) A compression lubricant fitting in upper yoke is provided to lubricate the stem and bushing threads and to reduce wear. A convenient shelf is cast on the inner sides of yoke arms for suspending the gland when renewing the packing.

All 150# valves are regularly packed with Teflon Packing. Globe, Angle and "Y" valves are available with metal or Teflon discs.

Globe, Angle, Gate and "Y" valves are back seated for repacking under pressure when fully open.

Consult your local Powell distributor or write directly to us.

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

SOME FACTS AND FALLACIES ABOUT PACKED TOWERS

☑ **Packed towers are practical in diameters over 3 ft.**

TRUE. Modern tower packings, such as "Intalox"® saddles and metal Pall Rings have made an old "rule-of-thumb" obsolete. Formerly, engineers were hesitant to use packed towers over three feet in diameter, especially where distillation was involved. However, the high efficiencies and low pressure drops of these new packings have made large diameter towers a practical and economical mass transfer tool. We can cite distillation, absorption and even liquid-liquid extraction towers in successful operation whose diameters run 8 ft. or more.

☒ **Packed towers give higher pressure drops than tray columns.**

FALSE. Because of their low pressure drops, "Intalox" saddles and metal Pall Rings have found wide application in vacuum distillation. In these rather critical rectifications, metal Pall Rings, especially, have such low resistance that pot temperatures —and product pyrolysis—are maintained at a minimum. Moreover, these low pressure drop properties lead to smaller tower diameters with greater liquid irrigation densities and lower H.E.T.P.

☑ **Packed towers have lower first cost than tray towers.**

TRUE. Again, this is true because of the development in recent years of unique packing shapes. Their high capacity and greater mass transfer efficiencies permit the design of shorter and narrower columns, requiring smaller fluid moving equipment. Where corrosion is a factor, the low cost of chemically inert ceramic packings means impressive savings over the cost of special corrosion-resistant alloys.

☑ **Packed beds make efficient entrainment separators.**

TRUE. Mist elimination sections consisting of packed beds are used in commercial scrubbing equipment, even where the scrubbing sections themselves consist of trays. Moreover, the chemical engineering literature quotes many actual installations in sulphuric acid and other plants where satisfactory performance is being obtained from packed beds. Where fouling is a problem, the choice of the proper packing with a large interstitial free space, combined with adequate hydraulic radius, will prevent deposition of solids and thus maintain low pressure drop.

☒ **Performance of packed towers can't be predicted accurately.**

FALSE. Today packed tower performance can be predicted about as accurately as that of plate columns. That was not true, however, ten years ago. Accurate design data are multiplying rapidly as the use of packed columns continues to grow at a rapid pace. Extensive research being made in packed towers up to 30″ in diameter is providing data that can be used to predict the performance of towers up to 25′ or more with reasonable accuracy.

YES, *the introduction a few years ago of "Intalox" saddles, and, more recently, the metal Pall Ring, used with properly designed packed tower internals, has brought about a re-evaluation of methods used to effect mass transfer . . . have made yesterday's facts, today's fallacies. In new tower design, or to obtain greater capacity or better efficiency from present towers, it will pay you to investigate modern packed tower performance.*

Are you on our mailing list to receive new technical data on packed tower performance as it is released from our experimental laboratories? If not, drop us a note on your letterhead. No cost or obligation. Write Dept. CEP-959, The U. S. Stoneware Co., Akron 9, Ohio.

90

U. S. STONEWARE

AKRON 9, OHIO

OUR 100th YEAR

DEVELOPMENTS . . .

SEPTEMBER 21, 1959

Chementator

C. H. CHILTON

Low-denier polypropylene fiber is now being made in the U. S. Reeves Bros. has begun commercial production of both staple and continuous filament yarns. Company began making large-diameter polypropylene monofilament last year.

Stauffer has developed a new pesticide now undergoing tests. It is methyl trithion, an analog of the company's already successful trithion.

Can a pulp mill be sued in one state for air pollution originating in another state? In a test case, Charlotte, N. C., residents have filed court action against Bowaters, operator of a pulp mill at Rock Hill, S. C.

Aerojet-General will study use of boiling sulfur as coolant for a nuclear reactor. Operation at 1,200 F. promises thermal efficiency as high as 50%.

Uranium process adds new versatility

First commercial uranium plant to combine alkaline leaching with resin-in-pulp ion exchange will go on stream late this year.

Uranium Reduction Co. is converting 880 tons/day of its present acid-leaching capacity at Moab, Utah, to alkaline leaching in order to more economically handle high-lime ores. One remaining acid-leaching circuit will continue to operate on low-lime ores. Break point will probably be in the 10-13% range of lime content. Economical treatment of ores running 20-25% lime will be possible, says URC, even though some of them contain only 0.17% U_3O_8.

Alkaline leach plants have heretofore recovered uranium by straight chemical precipitation from the filtered leach liquor. (Solvent extraction and ion exchange were developed primarily for acid-leach processes.) In one novel variation (*Chementator*, Feb. 24, 1958, p. 60), Fremont Minerals has combined acid and alkaline leaching with solvent extraction, but the leached slurry still has to be filtered.

By adapting RIP to alkaline leaching, URC avoids the need for installing costly filters in its conversion project. On the other hand, the flowsheet calls for thickening the slurry in order to recover and recycle two-thirds of the soda ash reagent. Over-all reagent cost will thus be well under the cost of sulfuric acid for acid leaching.

Contract maintenance hits labor snag

If you cherish the belief that hiring an outside contractor to take over your maintenance work will relieve you of your worst labor problems, take a look at what happened last month at a West Coast plant.

Fibreboard Paper Products Corp. signed a contract with Fluor which called for Fluor to supply all maintenance services to a complex of operations at Emeryville, Calif., producing

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After servicing, just flip lid down and clamp! Due to impregnated asbestos gasket seal, unit is now weatherproof. Exclusive louver ventilation eliminates condensation. Aim by looking through peep-sight, then lock in position . . . horizontal and vertical locking degree calibrations in each unit.

*A proprietary term of Aluminum Company of America

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paints, insulations, floor coverings and building materials. Some of the 76 Fibreboard maintenance employees affected accepted the change as an economic necessity and agreed to terminate their contract.

But one craft—the machine workers—objected, apparently because the Fluor maintenance crew belonged to a different union—the operating engineers. The machine workers picketed the plant, and the 600 Fibreboard employees who belong to other craft and industrial unions refused to cross the picket line, thus idling the entire plant.

Plant-wide contract maintenance is a relatively new activity, and its practitioners are anxious to make a good showing. Their chief selling point is that they can avoid the costly feather-bedding practices which are strongly entrenched in many plants.

But a few more jurisdictional strikes like that at Emeryville could set the cause of contract maintenance back by many years.

Magnetic shaft seals gaining favor

Though not offered as cure-alls in their present stage of development, magnetic mechanical seals show promise of becoming almost as indispensable to the process industries as the rotating pump and agitator shafts with which they can be used.

Engineers attending the Houston ASME Petroleum Mechanical Engineering Conference this week will hear a report by A. W. Chesterton Co. on experience to date with these novel devices. This Everett, Mass., firm has been instrumental in development of magnetic seals since their conception four years ago.

According to Chesterton, small size and light weight have figured prominently in the military's acceptance of magnetic rotary seals for containment of lubricating fluids. And elimination of problems associated with improper adjustment of conventional mechanical seals make magnetic units quite appealing to industry.

Instead of utilizing the mechanical push of a compression spring or bellows to hold the sealing faces together, magnetic seals rely on the non-mechanical pull of an Alnico 5 magnet used for the stationary face. The rotating member consists of a carbon-faced metal ring held to the shaft by friction of a compressed O-ring.

Primary operational difficulty thus far has been carbon wear when handling light, non-lubricating hydrocarbons, particularly at high pressures. Corrosion of the Alnico magnet was originally a stumbling block, but application of a heavy rhodium plate licked this trouble.

New insulation keeps it cold inside

A new, highly efficient system for insulating liquid hydrogen and helium containers was reported independently by both Linde Co. and National Bureau of Standards this month to the Cryogenic Engineering Conference at Berkeley, Calif.

System consists of alternating layers of aluminum foil and glass fiber mats in a jacket evacuated to 1.0 micron or less. Linde has filed patent applications on this type of insulation.

Linde's most efficient commercial system, designated SI-4, consists of 40 to 80 layers per inch of submicron glass fiber paper and aluminum foil. It has a thermal conductivity of only 0.000025 Btu./(hr.)(ft.)(deg. F.). And Linde has another in the lab stage which may have a k value as low as 0.000015.

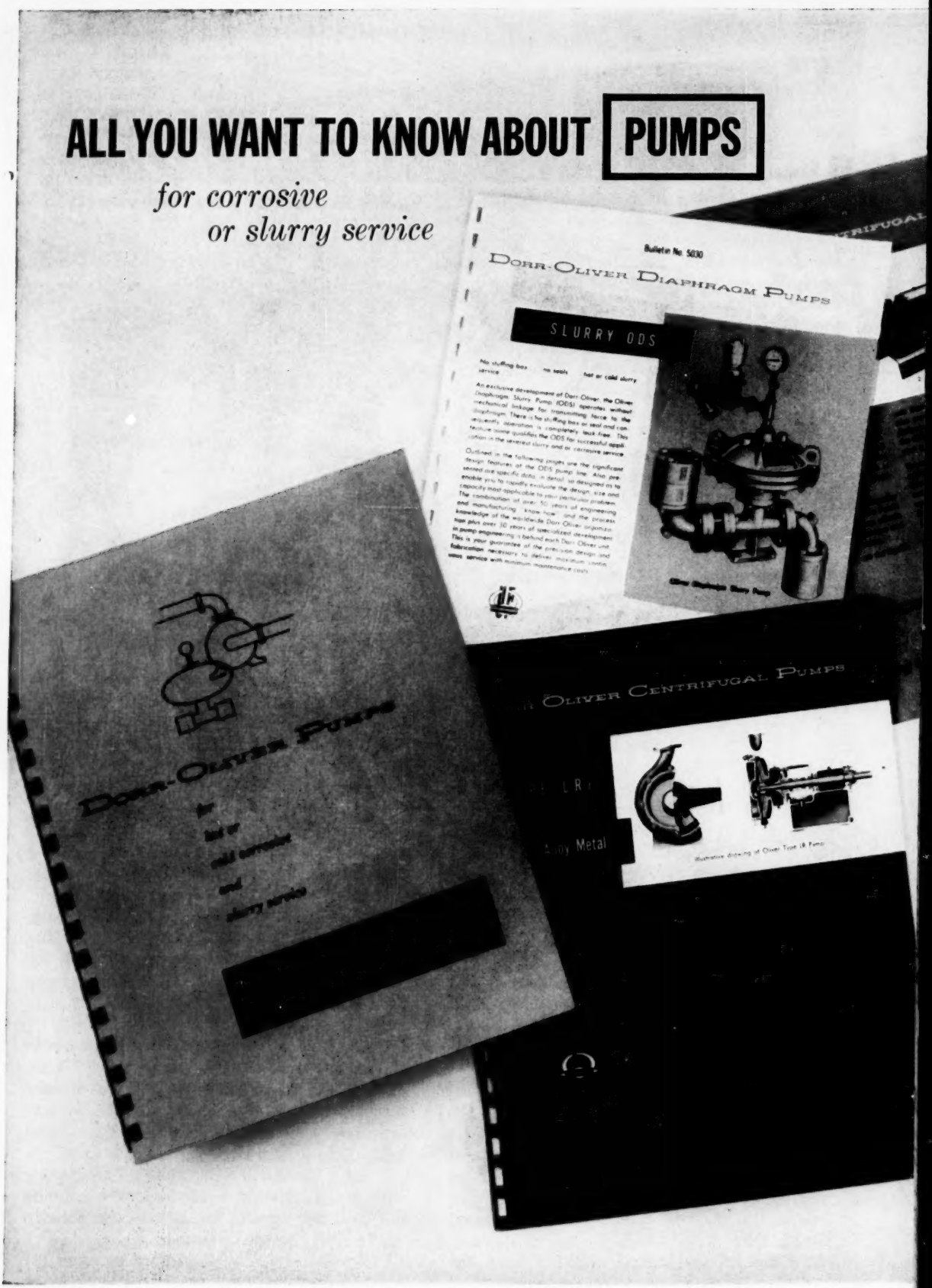
The 40-gal. liquid hydrogen cylinder in the photograph is insulated with only 1 in. of SI-4, yet has an evaporation loss of only 2%/day. Linde also has in service, in test or under construction liquid hydrogen and helium trailers in sizes up to 8,000 gal.

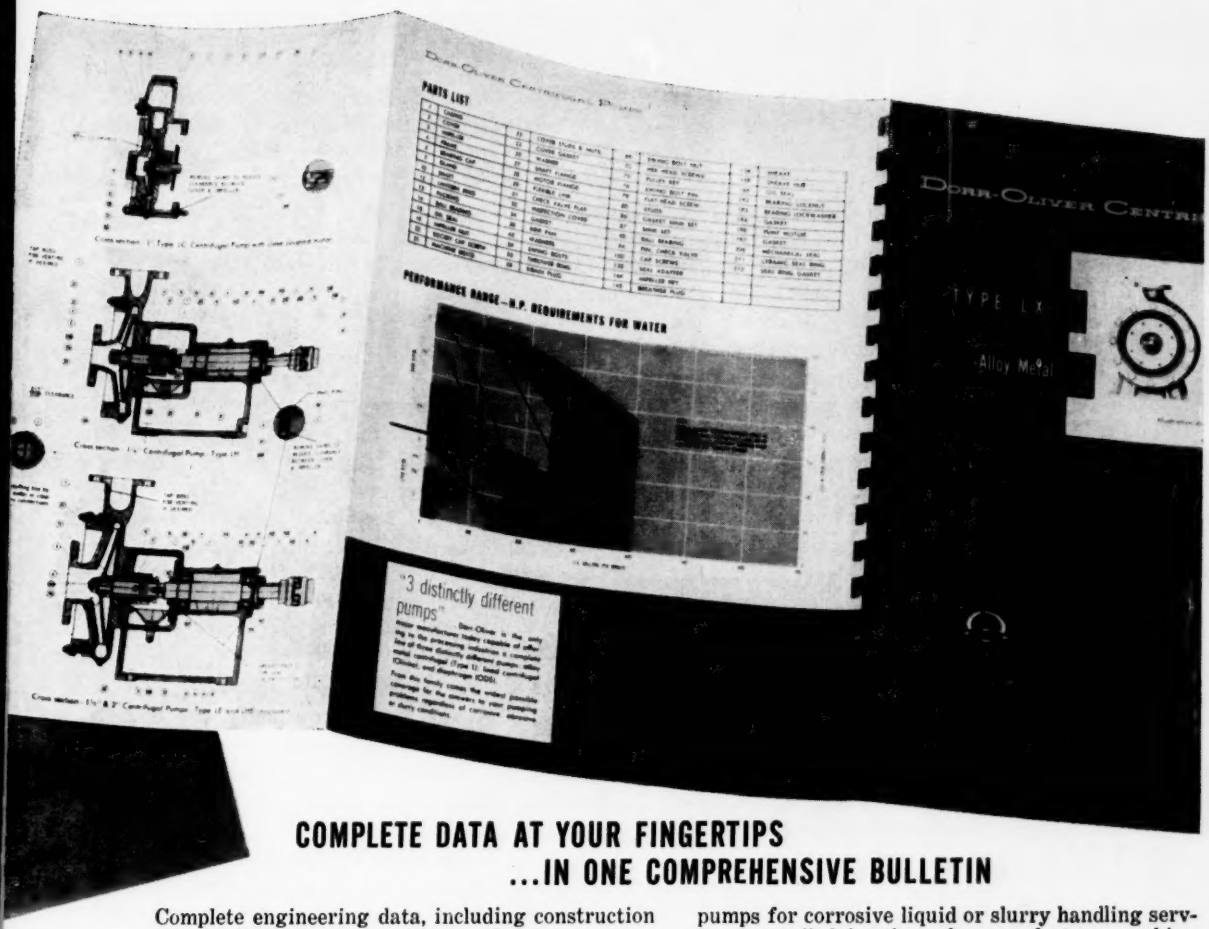
Both Linde and NBS discussed their work with vacuum-metal-powder insulations. Linde has used this type of insulation commercially

(Continued on page 72)

ALL YOU WANT TO KNOW ABOUT PUMPS

for corrosive or slurry service





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for several years but had not discussed it in detail previously.

The evacuated jacket (less than 10 microns pressure) is filled with a mixture of silica and metal powders. For silica, Linde uses Monsanto's Santocel, while NBS prefers Cabot's Cab-O-Sil. The metal powder can be either copper or aluminum. Although aluminum is apparently more effective, Linde has for safety reasons standardized on copper for its CS-5 insulation used in liquid oxygen service. Efficiency of CS-5 is much less than that of SI-4, but CS-5 is less costly and still adequate for many cryogenic uses.

NBS expressed hope of developing vacuum-powder systems with conductivities as low as laminar systems. One approach will be use of metal powders with particle sizes as small as 0.03 microns instead of the 20-40-micron aluminum powder used so far.

In another conference paper, Los Alamos (N. M.) Scientific Laboratory reported that overland hauling of liquid hydrogen by trailer has been going on for four years. Shipments originate at the NBS laboratory at Boulder, Colo., 400 miles away. Trailer carries 1,500 gal. per trip, with a vaporization loss of less than 10 gal.

Incentive pay cuts air pollution

Coke-oven workers at Kaiser Steel in residential Fontana, Calif., are possibly the most air-pollution-conscious operators in the process industries. And for a good reason: The cleaner their operations, the fatter their pay checks.

To determine pollution-control performance, Kaiser takes five pictures a day, on a random sampling basis, of each battery of 45 ovens. At the end of each week, evaluation of all pictures fixes stack, door and lid effluent ratings for each oven.

Supervisors then grade the responsible operators on a point-system basis. To qualify for a cash bonus, workers must keep their ratings below four points per week.

One point is the penalty for small leaks, two for heavier leaks. Leaks or stack emissions that exceed the Air Pollution Control District's regulatory levels carry a three-point fine. And if APCD issues a citation against a particular oven, responsible operators are docked 100 points; these points must be worked off before pay checks show any more bonuses.

According to Kaiser officials, workers are now caught up in the challenge of this plan. They are carefully watching check zones to keep violation times to a minimum and out of the camera's roving eye. One of the happiest notes is that the union has given its blessings to the venture and is helping management representatives establish incentive standards.

CE's road map defines petrochemicals

Mexican government last month announced the extent to which it intended to stretch its petroleum monopoly into the manufacture of petrochemicals.

A new official regulation puts basic or first-generation petrochemicals under government control. And how does the government define these chemicals? By means of *Chemical Engineering's* petrochemical "road map," published as part of our recent feature report on "Chemicals From Petroleum" (May 18, 1959, pp. 151-168). In trying to clarify the complicated world of petrochemicals at a press conference in Mexico City, cabinet officer Eduardo Bustamente pulled out his copy of *CE* and flipped to page 153.

A new government agency—as yet unnamed—will run the basic petrochemical business. Pemex, the petroleum monopoly, will stick to petroleum production and refining.

Tomorrow's Technology

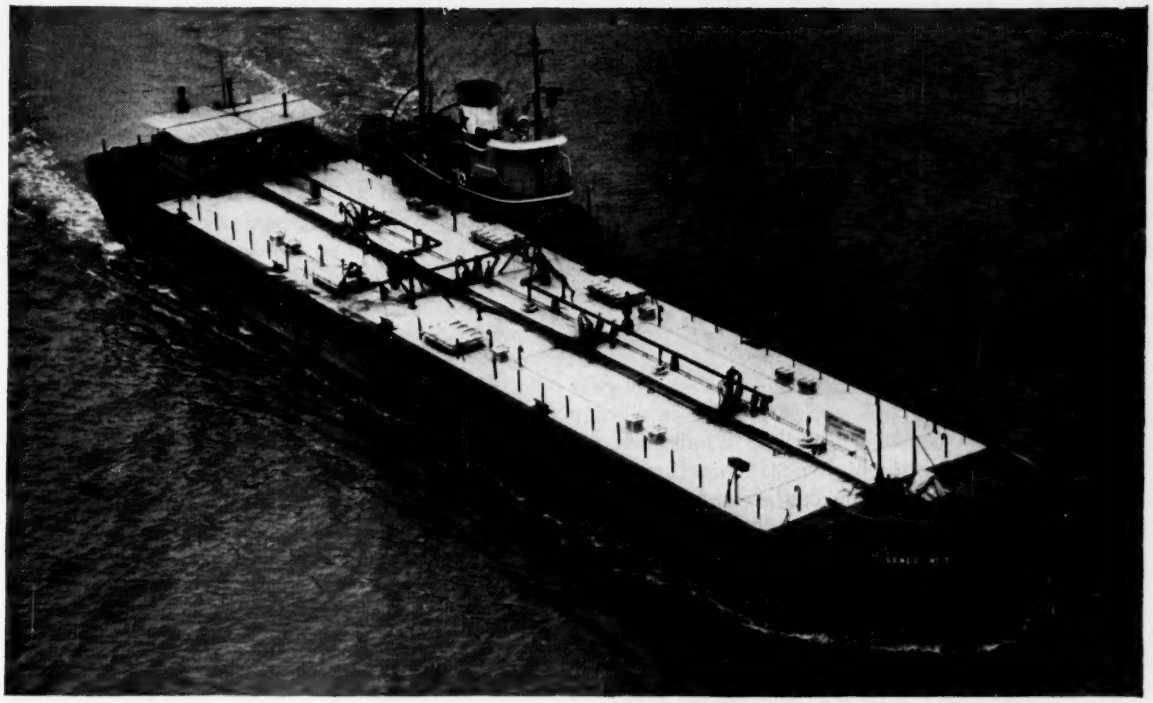
Today's embryonic developments which have special significance for chemical engineers

Progress in fuel cell research

A high-pressure (400 psi.) hydrogen-oxygen fuel cell with an output of 5 kw. has been successfully demonstrated in England and will be further developed in the U. S.

Credit for this achievement goes to F. T. Bacon, whose work has been sponsored by the British government's National Research Development Corp., Cambridge, England, to the tune of some $225,000. In the demonstration last month, the Bacon cell operated a fork truck lifting a 2-ton load, a circular saw cutting through a chunk of mahogany, and a welding machine.

Shortly thereafter, Bacon departed for the U. S. to present a scientific paper to the



Capacity—2000 tons of sulfuric! *The "Genco 7" is the largest in General Chemical's fleet of eight sulfuric acid barges.*

Call on **GENERAL CHEMICAL** for ***Sulfuric Acid*** ...*As you need it!* ...*When you need it!* ...*Where you need it!*

Whether your sulfuric acid requirements are measured in thousands of tons or carboy lots, General Chemical is best equipped to handle your order.

General's extensive network of production facilities plus its large and flexible transportation system assures you of sulfuric as you need it . . . when you need it . . . where you need it!

For example, we have eight sulfuric barges serving customers along the Atlantic coast and on inland waterways. Three operate out of Marcus Hook (Philadelphia), Pa. Two in the New York City area, including the 2000-ton capacity "Genco 7" shown above. Three on inland waterways. General also operates the largest fleets of sulfuric tank cars and tank trucks in the country.

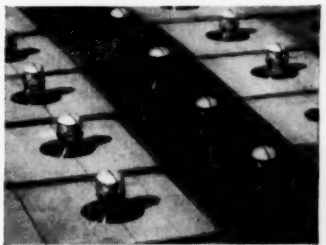
General Chemical has 21 sulfuric plants,* as well as stock points in key industrial centers across the country. Each is geared to meet regional requirements, offering customers the advantages of "next door" location to General's modern facilities. In addition, the output of one plant backs up that of another, making a coast-to-coast supply line which proves invaluable in meeting emergencies or unexpected demands.

Why not find out how our long experience and extensive facilities can benefit you? For further information, write or phone the nearest General Chemical sales office.

**In Canada: Allied Chemical Canada, Limited*

Large fleets of tank transports provide fast over-the-highway service.

By far the largest fleet of sulfuric tank cars is operated by General Chemical.



General Chemical sulfuric acid is also available in 13-gallon carboys.

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N. Y.

American Chemical Society in Atlantic City last week and, no doubt, discuss business with owners of U. S. patent rights, Universal Winding Co. and Pratt & Whitney Aircraft..

Eight other speakers joined Bacon in a fuel cell symposium at the ACS meeting, representing firms such as General Electric, National Carbon and Consolidation Coal, as well as several research institutes.

Bacon's demonstration cell is a compact 12 in. dia. by 30 in. long. But the control gear for supplying pressurized gases—weighing around 700 lb.—was described as bulky enough to fill the rear of a big truck. Reduction of this bulk is now the main engineering problem.

For a thorough review of fuel cell technology—including the Bacon cell—see *Chem. Eng.*, Dec. 1957, pp. 154-158.

Isotopes look for new jobs

Among the 59 isotope research contracts awarded by AEC in recent weeks is one to Aerojet-General Nucleonics for development of an instrument which will measure temperatures and pressures. Instrument will operate on the principle that isotopes emit levels of radiation which vary with temperature and pressure.

Under another contract, Evans Research & Development will work on a method for determining sizes of very small particles. Here the principle is that the smaller the particle size, the greater the attenuation of radiation passing through the sample. If successful, method might be used for production control by manufacturers of such products as cement, paints and photographic film.

Another study at Georgia Tech will try to create fine particles by radiation crushing of kaolin (cf. work on coal, *Chementator*, June 1957, p. 142). And a Lockheed project aims at development of an isotopic technique for detecting failures in heat-exchanger tubes.

Ceramic glues withstand heat

Inorganic adhesives which retain structural strength at high temperatures are getting close scrutiny by chemical manufacturers and aircraft builders.

Boeing Airplane Co. last month got a $100,000 Navy contract to develop and test stainless steel structural components bonded with ceramic adhesives. The Air Force previously awarded Boeing a contract to fabricate test sandwich panels bonded with ceramics.

Boeing has an adhesive good for use up to 800 F., with a potential of even higher temperatures. Other companies known to be working with ceramic adhesives include Convair, Aeronca, Aerojet, Minnesota Mining, Narmco and Corning Glass.

Adhesives based on epoxy resins are today worth their weight in gold to the aircraft industry. The B-58 Hustler, for example, uses over 800 lb. of epoxy adhesives at a net savings in weight equivalent to an added payload of 2,300 lb. Convair's new 880 jet airliner also depends on adhesive bonding.

But as aircraft builders strive for still greater speeds, temperature limitations of organic adhesives present a problem. The answer may lie in use of the new inorganic adhesives based on glass and ceramics.

These materials can be applied by spraying, brushing or dipping. The joint is then cured in an oven at a temperature high enough to fuse the adhesive into a strong bond which will not soften at any service temperature below that at which it has been cured.

The ceramic composition must be tailored to have a thermal expansion closely matching that of the structural metal. This requirement is relatively easy to meet. Tougher problem—brittleness of the ceramic joint.

Here's a challenge to engineers

WANTED—Seven million afterburners by Jan. 1, 1961, in the State of California. Must eliminate 95% of olefinic hydrocarbons from motor vehicle exhaust. Must carry minimum-life guarantee of at least 1 yr. Installed price must not be more than $50 higher than ordinary muffler for same car. Others need not apply. Air Pollution Foundation, San Marino, Calif.

This is not a real want-ad, but it could be. The need is real, as is the opportunity for some smart engineer to win fame and fortune in southern California's fight against smog.

As Air Pollution Foundation points out, basic research has already produced enough scientific information to make possible either a catalytic or direct-flame afterburner. (A catalytic device would have to be immune to effects of phosphorus, boron and sulfur, as well as tetraethyl lead.) The big hurdles are engineering problems of size, first cost, ease of maintenance and life.

For more on DEVELOPMENTS.....76

NOW—4 GREAT "NAMES" UNDER ONE ROOF!

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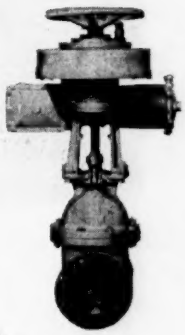
Now combined with the Foster Engineering Division in a modern 112,000 square foot plant in Warwick, Rhode Island, the Hammel-Dahl Division produces a complete line of pneumatic control valves—diaphragm or piston operated, split or integral bodies for every application.



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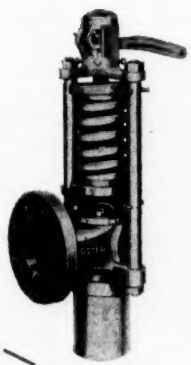

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A product of General Controls own research and development program, the Hydramotor® is one of the most widely used industrial valves in the country. By combining the powerful electro-hydraulic operators with a variety of valve bodies, the Hydramotor® offers tremendous power for high-pressure, high-flow applications. Fail-safe, simple two-wire control.

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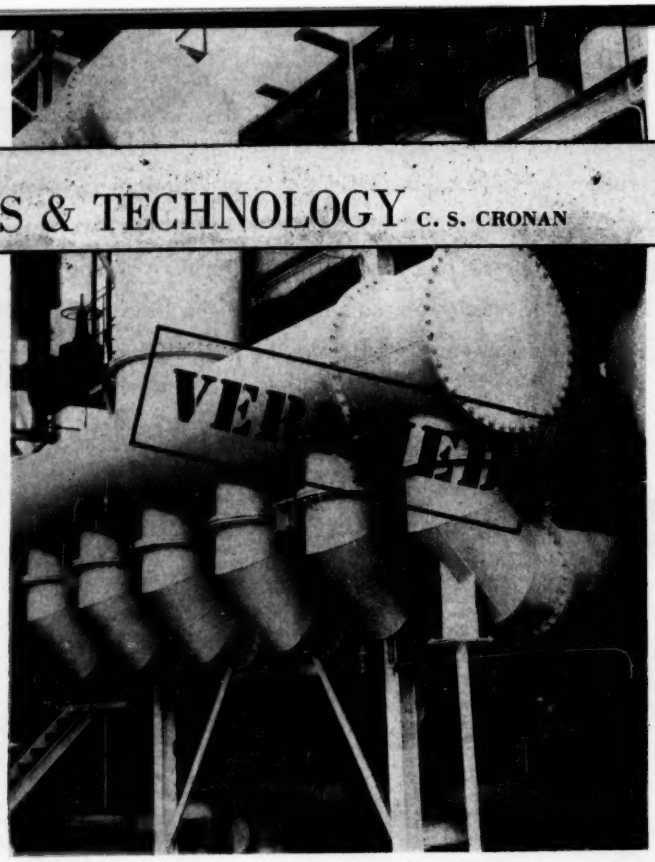
$h_G (T_G - T_c)$ $+K_G M_v$ . . . with



Plant Tests Check Transfer Correlation

Correlation for heat and mass transfer gets belated scrutiny of full-scale tests. Result: It's a good rule, with a few buts.

For years, chemical engineers have based condenser-cooler designs on the Colburn-Hougen correlation for simultaneous heat and mass transfer. Since Colburn and Hougen first published their work 25 years ago, this relationship has provided a powerful tool to compute rates of condensation of a vapor from a noncondensing gas.

Yet, until recently, the correlation has been verified only on a lab scale.

Now actual tests have been made on a commercial battery of heat exchangers. These tests confirm the correlation and pinpoint the precision of the calculation methods (see table above).*

► **Exchanger Tests**—Tests were made at Consolidated Chemical Industries' Houston, Tex., plant on a battery of six shell-and-tube exchangers (freshly cleaned) which cool and dehumidify gases (10% SO_2) from burning acid sludge and spent alkylate sulfuric acid.

Each 37-in. I.D. vertical counterflow exchanger contains 439 Karbate impervious graphite tubes, 14 ft. long, 1¼-in. O.D., ⅞-in. I.D. Experimenters varied heat loads by changing, each run, the number of (gas) tubes and (water) shells used.

► **Slightly Inconsistent**—Authors of the paper point to some inconsistencies unearthed by the experiments.

Prior single-tube data indicated that the Colburn-Hougen correlation and methods of calculating gave results on the conservative side—that is, asked for more surface than was needed. In these large-scale tests, however, computed surface proved to be less than that required (see table above).

Moreover, the higher the inlet velocity of the vapor, the greater the deviation. Thus, a typical compressor intercooler, operating at a pressure drop

* See paper given by J. E. Revilock, others, at the August AIChE-ASME heat transfer symposium.

$$\lambda(P_v - P_c) = h_{oi}(T_c - t_w) = U(T_G - t_w)$$

these important modifications:

1. Computed values are on the low side
2. Deviation increases with pressure drop

Run	Heat Exchanger Surface, Sq. Ft. Computed from Correlation	Required in Plant Tests	1. % Deviation Computed vs. Required	2. Pressure Drop In. H_2O
1	11,826	12,050	—2	5.8
2	7,315	8,032	—9	12.2
3	7,412	8,032	—8	13.0
4	9,500	10,040	—5	8.7
5	9,660	10,040	—4	8.7

larger than those used in the experiments, may introduce still greater errors.

▶ **A Closer Look**—The authors feel that the agreement of experimental results with those predicted by the correlation is unusually good, considering that these assumptions in the correlation are questionable:

- Equilibrium exists at any cross section of the tube such that condensate on the wall, by virtue of the heat balance, is never subcooled. However, in some industrial operations, condensate has left the exchanger at a lower temperature than the dewpoint of the original mixture.
- Diffusion is completely independent of any temperature gradient between the vapor and the condensate. This assumption, the authors feel, would give very conservative results at large temperature differences.

▶ **Dirty Conditions**—The test results cast new light, too, on the realistic use of fouling factors in calculating necessary heat transfer surfaces. Apparently, Kern's modification* of Colburn and Hougen's method reduces the spread of under- and overdesign of exchangers working under dirty conditions (see table, below.)

Colburn and Hougen's use of a fixed fouling factor throughout the graphical, trial-and-error integration is, according to the authors of the paper, "something of an anomaly." At the inlet end of the exchanger (where most of the heat is transferred) the fixed fouling factor may become the limiting resistance, while at the outlet end (where more surface is required per Btu. transferred) it may be inconsequential.

In such cases, the significance of the fouling factor varies with each combination of inlet and outlet dewpoints and may lead to unsafe design.

Kern recommends that integration be carried out on the basis of clean over-all coefficients between inlet and outlet. Design coefficient is then obtained by adding the desired fouling factor to the reciprocal of the weighted, clean, over-all coefficient for the entire unit.

*Kern, D. Q., "Process Heat Transfer," pp. 339-351, McGraw-Hill Book Co., New York (1950).

Kern's Surface Allowance for Fouling Is More Precise

Run	Heat Exchanger Surface, Sq. Ft. (Clean) Used in Plant Tests	(Fouled) Computed by: C-H	Kern	% Oversurface (Fouled vs. Clean) C-H	Kern
1	12,050	12,865	13,280	7	10
2	8,032	8,506	8,750	6	9
3	8,032	8,524	8,630	6	8
4	10,040	10,190	10,900	1	9
5	10,040	11,733	11,080	17	10

Tank Trucks Open Fluorine's Future

New techniques developed to handle and transport tonnage fluorine for defense bring this powerful oxidizer into focus for large-scale chemical use.

Tamed for rocket use, tonnage fluorine now is knocking on chemical makers' doors looking for work.

Until recently, direct fluorination has been limited commercially to very large operations which can justify producing upwards of 1 ton/day of fluorine on site.

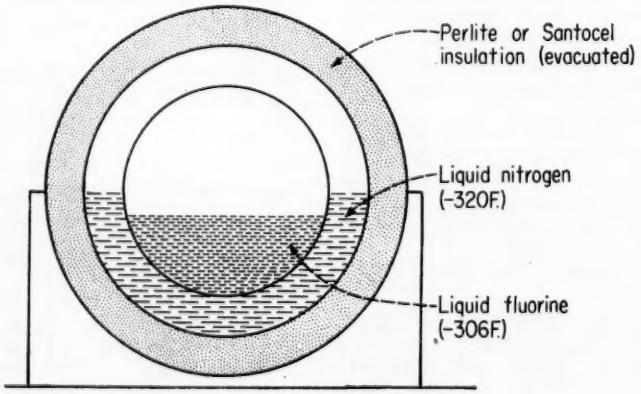
Now, handling and haulage techniques developed originally for the rocket industry by General Chemical Div., Allied Chemical Corp., enable any chemical manufacturer to order liquid fluorine by the ton.

▶ **Handling Secrets** — General Chemical labored more than 2 yr. to develop a tank system that has no moving parts or mechanical refrigeration.

Weighing 10 tons with a fluorine capacity of 2½ tons, system consists of three horizontal cylindrical tanks, one inside the other.

Innermost tank contains liquid fluorine. Annular space between the fluorine (−306 F.) and the second tank is filled with liquid nitrogen (−320 F.). Outer annular space between second and third tanks is filled with perlite or Santocel insulation and is evacuated. Liquid nitrogen prevents fluorine evaporation; highly efficient outer

Triple-Shelled Tank Keeps Fluorine Cold



the meter with NO flow restrictions

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With easy-to-measure liquids, or with tough ones like those listed below, the performance-proved Foxboro Magnetic Flow Meter provides flow measurement with no line restrictions. For complete details, write today for Bulletin 20-14C. **The Foxboro Company, 369 Neponset Ave., Foxboro, Mass.**

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MAGNETIC FLOW METERS

insulation effectively minimizes nitrogen losses.

▶ **Transfer preliminaries** — Before stationary storage tanks, similar to transit tanks, can receive liquid fluorine they undergo rigid purging.

First, nitric-hydrofluoric acid mixture removes any scale from lines and vessels. Then, cold trichlorethylene, followed by hot silicate-free alkali, removes solvent- and water-soluble greases, oils and residues.

Storage system is then rinsed with deionized water and inspected. Ultraviolet light reveals any remaining oils. For rocketry purposes, instrument analysis of solvent rinse may be required.

▶ **Passivate With Fluorine**— Next, system must be dried with acetone, purged with anhydrous nitrogen and tested for tightness with 60-psi. helium and soap bubbles.

Then gaseous fluorine is slowly bled into system from standby cylinders to passivate or form an inert fluoride film on all metallic surfaces. Up to 5% HF in the passivating gas accelerates passivation at lower temperatures.

When exhaust gas, bled from the system, readily burns propane gas from a cylinder source, the system is ready. Helium pressure, gradually admitted to truck tank, transfers liquid fluorine to the stationary storage tank.

▶ **Design Considerations** — Research reveals that, as a rule, the same materials of construction may be employed for liquid fluorine as for the gas. Any metal that forms the protective fluoride film will stand up.

However, several handling problems remain unsolved. No pump has been developed for liquid fluorine service. Friction imposed on internal surface of mechanical pumps removes the passive fluoride film required. Present research at General Chemical laboratories aims at the solution of this and other handling problems.

▶ **Rocket Uses** — Even though some handling problems remain to be solved, the system is working well to satisfy rocket needs.

The rocket industry's keen interest in fluorine stems from its high-performance characteristics as an oxidizer in bipropellant systems. Hydrogen-fluorine system offers the highest known specific impulse (SI) —370-430 lb. thrust/lb./sec. of exhaust gas, or 35% more than the SI for any other present system.

National Aeronautic & Space Agency (NASA) recently contracted with Bell Aircraft Laboratories, Niagara Falls, N. Y., to continue its research efforts on this system, begun in 1956. Efforts at Bell aim at developing materials to withstand operational friction and pressure of fluorine flow in rocket engines.

Rocketdyne Div., North American Aviation Corp., too, is researching the hydrogen-fluorine system at its Canoga Park, Calif., facilities. Bell, Rocketdyne and NASA all pattern their liquid-fluorine handling techniques after those pioneered largely by General Chemical.

▶ **Chemical Prospects**—With experience in fluorine handling now well established in the rocket industry, interest focuses on where it first may be applied in the chemical industry.

Foremost among such prospects, of course, is in production of UF_6, feed material for the USAEC's gaseous diffusion plants (*Chem. Eng.*, March 23, 1959, pp. 140-143).

Among other highly fluorinated chemicals for the space age that use elemental fluorine are: highly stable fluorocarbon rocket-engine lubricants; some super solvent-resistant fluorinated silicones, vinylidene, butacrylate and perfluoropropylene.

Still another processing frontier is the replacement of metallurgical routes to space-age metals with simpler chemical routes. NASA is developing one to high-purity tungsten for rockets via reduction of tungsten hexafluoride.

New Effort Probes Frontier of Fusion

Unsung til now in the brief annals of man's attempts at controlled thermonuclear reactions (*Chem. Eng.*, Feb. 24, 1958, p. 70) is a 1-ft.-long, 1.2-in.-dia. glass tube at the Naval Research Laboratory in Washington, D. C.

But now there are indications that this tube may actually have achieved fusion in a deuterium plasma. Compression data, magnetic-field strengths and final densities, says Navy scientist Alan Kolb, are consistent with plasma particle energies in the range of 10 million to 15 million C.

Key question is whether neutrons given off are false or are products of fusion reaction. While not claiming flatly that the 100 million neutrons given off in Navy experiments are thermonuclear, Kolb maintains that there has been no evidence that they are false. To support this, Kolb points out that there is every indication that the highly energized deuterons are racing around in a random motion, one symptom of thermo nuclear reactions.

Ammonia Process Waste Gives Up Pure Argon

By further processing a waste stream at its Vicksburg, Miss., ammonia plant, Spencer Chemical Co. now recovers up to 100,000 cu. ft./day of argon. Argon comes into the over-all process picture from an air-liquefaction plant which supplies oxygen to make hydrogen from natural gas.

After oxidation of natural gas, hydrogen is scrubbed free of impurities—including argon —by liquid nitrogen. Bottoms from this step contain about 14% argon. Hence it's better to recover argon here than from the oxygen plant where it exists only in concentration of about 4%.

Spencer takes the bottoms stream, cools it to about–300 F. and feeds it to a fractionator which splits out an argon-rich stream. This is heated to eliminate CO and methane which burn with some of the remaining oxygen to form CO_2 and water. After scrubbing, hydrogen is added and gas is reheated, eliminating oxygen by forming water. Low-temperature separation of water leaves pure argon.

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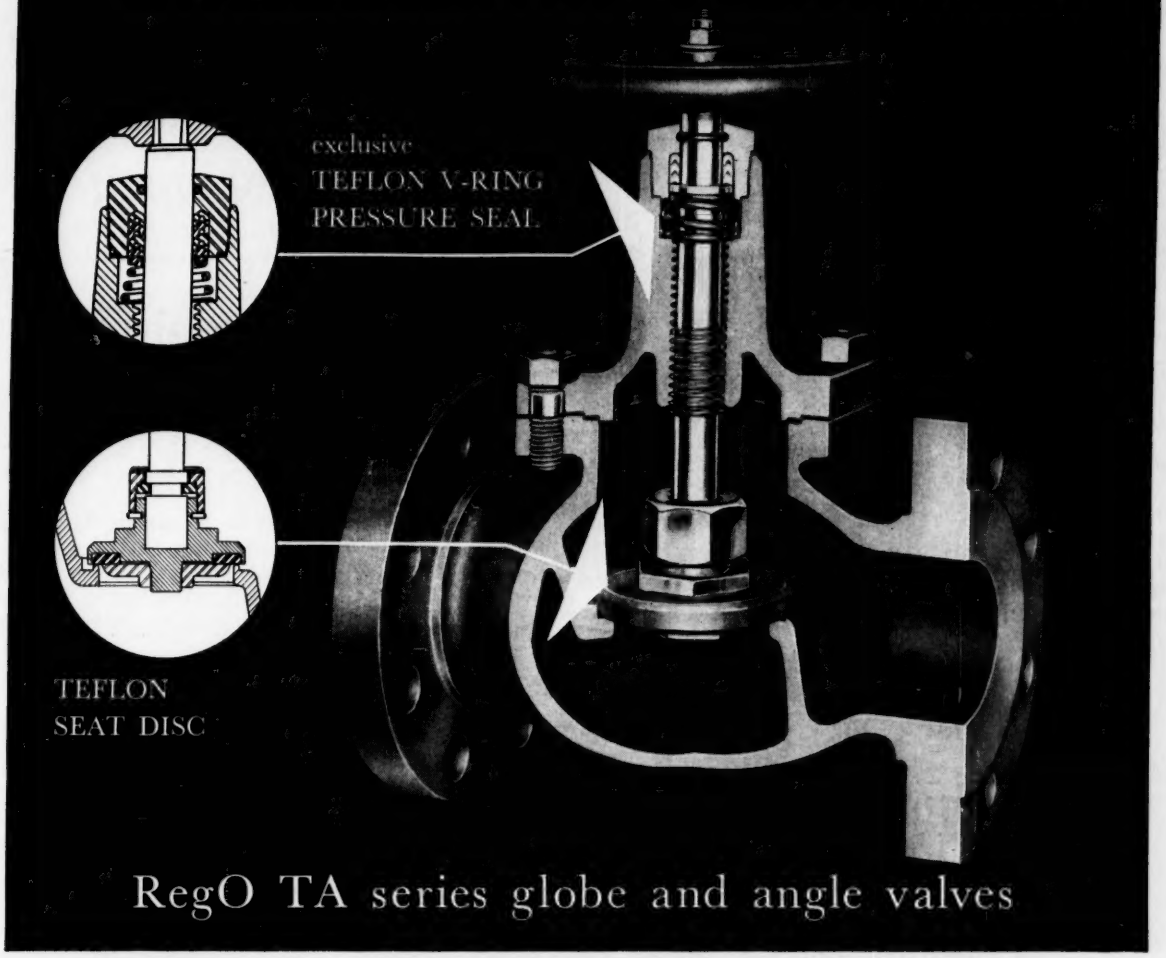

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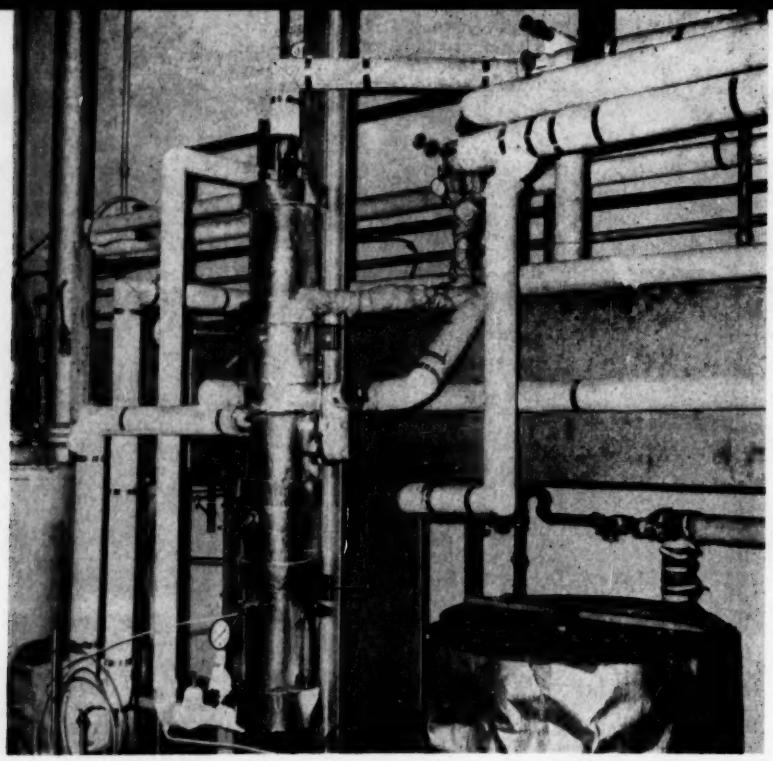


PURIFICATION column with cold condenser gives good yield of pure HF.

Shutting Out Air Ups Process Yield

Engineers squeeze 15% more yield out of HF process by effectively sealing off all air leaks to kiln-reactor.

Heeding rising demand for hydrogen fluoride by plastics, nuclear and rocket industries, Chemical Construction Corp., New York, N. Y., has proved out its own HF process, is now offering it commercially.

Using this process, Chemico boasts up to 15% higher yield than HF processes currently employed by large-scale captive HF producers. Keys to increased efficiency are innovations developed by Chemico engineers at its ¼-ton/day pilot plant in New Brunswick, N. J.

▶ **Secrets of Savings**—Pilot-unit operation revealed that air leakage into the reactor, where fluorspar (CaF_2) and sulfuric acid first meet, greatly affects the efficiency of HF-purification steps that follow.

Newly developed seals that withstand necessary pressure, high temperature and severely corrosive operating conditions improve the operation by locking air out of the kiln. Seals are designed with a view toward simplicity, minimizing of alignment problems and easy maintenance. Patent applications are being prepared.

Engineers working on this project found that they could control corrosion most easily by confining it to equipment that is easiest to replace.

Concurrent with process development, a thorough and extensive corrosion-testing program has been conducted at each process condition. Using knowledge gained from these tests, Chemico design engineers feel able to select construction materials that will optimize the capital investment-maintenance cost relationship.

Another key to controlling corrosion is use of a packed tower to remove practically all water from the product gas before it enters the purification system. Gas containing HF is not nearly so corrosive dry as it is wet.

▶ **Making the HF**—At Chemico's pilot plant, fluorspar enters a feed hopper and screw feeder leading into an externally fired, kiln-shaped reactor. Here it mixes with sulfuric acid at 300 F. Temperature profile rises as the reactants pass through the unit, assuring maximum conversion of fluorspar to HF.

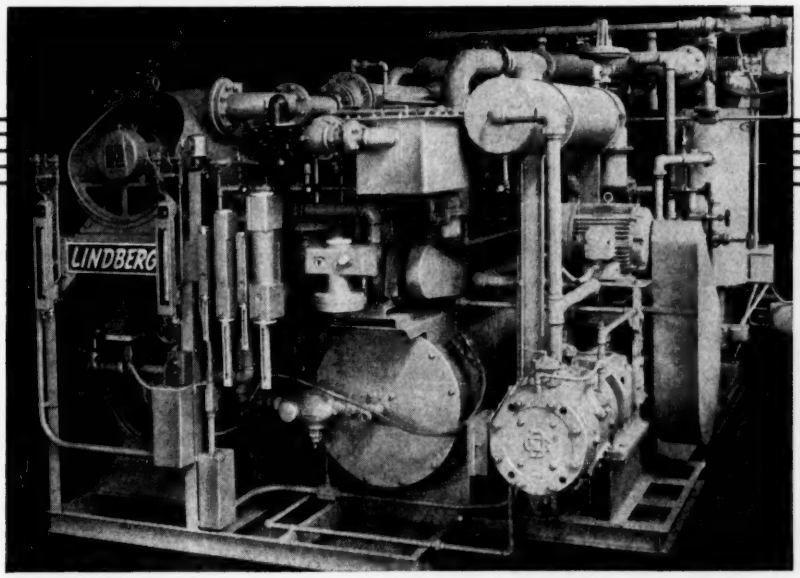
Leaving the reactor at the

*Atmosphere of 99.99% inert gases now provided by new Lindberg HYNI Generator

**Completely new, fully automatic, dry process provides highest degree of nitrogen purity

***This process produces nitrogen for only $0.17 to $0.20 per 1000 cubic feet

In chemical processing, this superior nitrogen atmosphere is useful in blanketing processes under non-flammable, non-oxidizing, non-toxic, and bacteria-free conditions. It is ideal, too, for purging, bubble agitation, displacement of air, and pneumatic conveying. In the metals industry, this high purity nitrogen atmosphere is used for annealing, normalizing, brazing, hardening, and sintering. In food processing this inert atmosphere protects product quality, flavor, color, odor and appearance from contamination, oxidation, or bacterial action.



This new HYNI generator is an important addition to Lindberg's complete line of controlled atmosphere generators. It is available in capacities from 1,000 to 10,000 SCFH. Write us for complete information on this remarkable new unit, and other Lindberg generators for any required atmosphere type.

** How The Process Operates

This 99.99% pure atmosphere is produced by a completely new, dry, fully automatic process. It uses the principle of burning a hydrocarbon fuel in a separate catalytic combustion chamber to obtain complete reaction without unburned methane, high residual oxygen or a high percentage of oxides of nitrogen. Carbon dioxide, water vapor, sulphur dioxide or hydrogen sulphide are simultaneously removed in a dry, absorbent material known as Molecular Sieve made by Linde Division of Union Carbide and Chemical Corporation.

* Sample of Analysis Obtainable With HYNI Generator

Oxygen	0.00%
Carbon dioxide	0.01%
Hydrocarbons	0.00%
Water vapor: Less than -80° F. dewpoint (7 p.p.m. when measured by a Beckman Hygrometer)	
Hydrogen	0.00%
Carbon monoxide	0.00%
Sulphur	0.00%
Oxides of nitrogen	0.00%
Nitrogen and Argon (trace)	99.99%

*** This Process is Economical

One of the advantages of this process of producing nitrogen is its low cost. With the HYNI Generator the nearly-pure nitrogen is produced for only $0.17 to $0.20 per 1000 cubic feet. Cost of power, raw gas and cooling water is included and based on: fuel gas at $0.60 per 1,000,000 BTU; electricity at $0.01 per KWH; cooling water at $0.05 per 1000 gal. Quoted cost does not include maintenance or amortization. Lindberg quality design and construction assures complete dependability and lowest maintenance cost.

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GAS PROCESSING DIVISION
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feed end, gas containing HF flows upward through a water-jacketed, packed tower and then through a horizontal, water-jacketed precooler.

Packed tower removes entrained dust, water and acid droplets, while the precooler condenses remaining water vapors from the gas stream. Precooler condensate recycles to top of packed tower.

Reaction byproduct, calcium sulfate, leaves the reactor opposite the feed end.

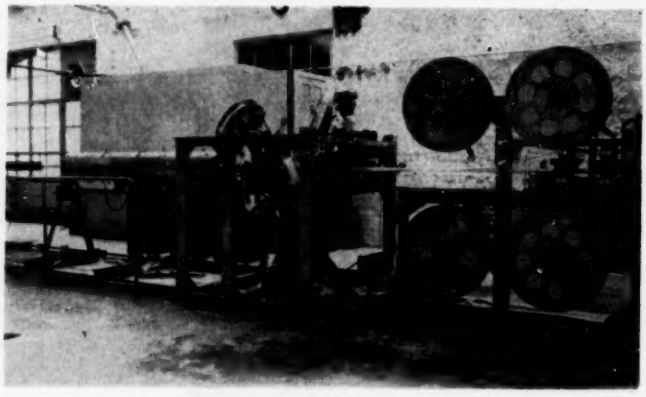
► **Purifying the HF**—Precooled dried gas flows to a two-column fractionation system for final purification.

Feed to the first column contains HF, N_2, SO_2, CO_2, SiF_4, some H_2SO_4 and H_2O. Tower bottoms, containing high boiling H_2SO_4, H_2O and some HF, recycle to the packed tower above the kiln-reactor.

Inert gases are vented from the tower through a refrigerated condenser to minimize loss of HF. Condensate, bearing HF values, is recycled to the top of the tower for reflux.

Concentrated HF from an intermediate plate in the first column flows to a second column where remaining SO_2 is fractionated off. Result is a high-purity, 99.9% hydrogen-fluoride product that meets AEC specifications.

Overhead gases from both purification columns flow through a direct-contact scrubber where alkaline water scrubs SO_2 and traces of fluorides from the vent gases.



Plastic-Pipe Producer Can Be Trailer-Mounted

Although in a late developmental stage, the unit above is now turning out reinforced thermoplastic tubing at Stratitub Co.'s plant at Elbeuf in Normandy, France. Pipemaker, developed in France by Rene Imbert and Pierre de Vinzelles and patented in the U. S., can continuously produce tubing up to 2¾-in. I. D. at a rate of 6-8 ft./min. Unit can be mounted on a trailer or truck. According to the inventors, layers of polyester-impregnated fiberglass are fused into a rigid tube in a matter of seconds by a high-frequency polymerization method in horizontal pipe at left. Unit can produce a porous tubing mainly for structural purposes or a leak-proof tubing capable of withstanding pressures of 1,500 psi. or more. Now under consideration is a unit to make piping up to 16 in. I. D.

NEWS BRIEFS

Trimellitic anhydride: Amoco Chemicals Corp. has started construction on a multimillion-lb./yr. plant at Joliet, Ill., to make trimellitic anhydride. Plant is expected to be on stream by middle of next year, will oxidize trialkyl benzenes, then dehydrate acid to form the anhydride.

Aluminum: Russia plans to build an aluminum plant, "one of the biggest in Soviet Russia," near Pavlodar in northeast Kazakstan. Plant reportedly will use a new bauxite-processing method which eliminates need to sinter aluminum. Presently under construction near Pavlodar is a pilot plant that will carry out practical tests on new method.

Propellant chemicals: Aerojet-General Corp. is now readying a new pilot plant at its Sacramento, Calif., facilities to produce dinitro chemicals useful in developing new solid propellants.

Butadiene: Texas Butadiene & Chemical has contracted Hess Terminal Corp. to build and operate a specially designed butadiene terminal on the Houston ship channel. Butadiene, pumped from TB&C's Channelview, Tex., plant through an 11-mi. pipeline, will be stored at 35 F., in two 4,000-ton-capacity ellipsoids. It is expected that butadiene can be stored at this temperature for six months without deteriorating in quality. Connecting pipelines will permit loading of ocean-going ships at a rate over 250 tons/hr.

Mideast oil products: Arabian American Oil Co. has completed a $7-million, 1,200-bbl./day sulfuric acid alkylation unit at its Ras Tanura refinery in Saudi Arabia; announced plans to build a 4,000-bbl./day plant at Ras Tanura to make liquefied petroleum gas available for tanker shipment, plant due on stream next August; offered unprocessed natural gas for sale.

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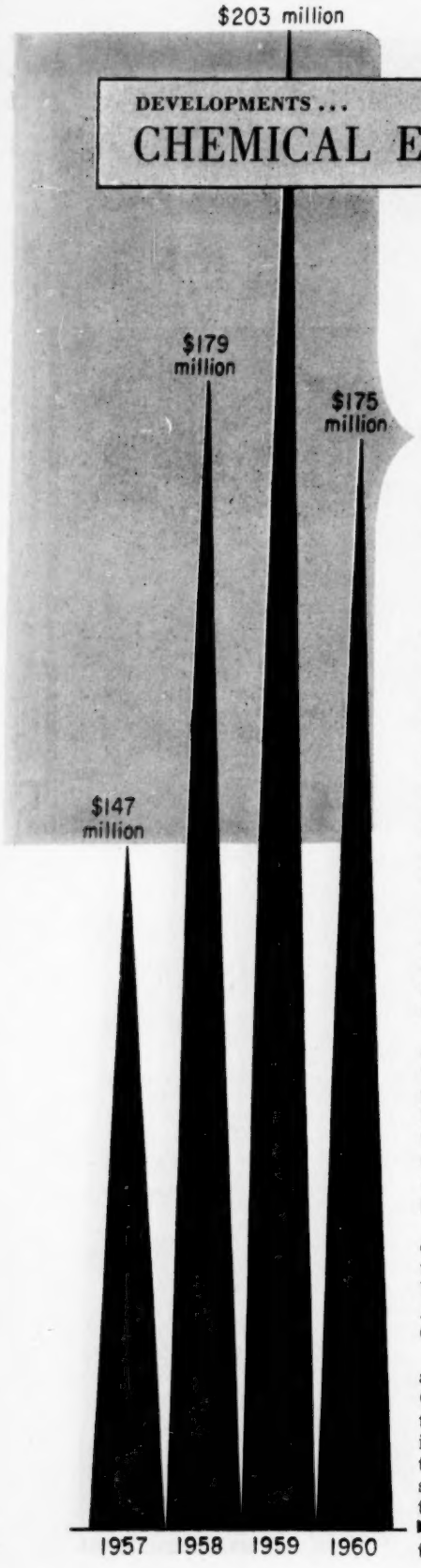

$700,000,000 In Four Years

That's how much chemical firms are spending in 1957-60 on overseas plants in order to meet foreign competition in its own backyard.

American chemical processors, both alarmed and intrigued by revitalized foreign industry and markets, are spending as never before to set up production facilities overseas.

From a level of $147 million in 1957, chemical capital spending overseas rose to $179 million the next year, will soar to $203 million this year, will follow that up with at least a solid $175 million next year.

This four-year splurge adds up to more than $700 million for overseas expansion — perhaps 12% of all capital spending here and abroad by U. S. chemical companies for the same period.

And this 1957-60 pace puts the chemical industry third (and very close to second) among all manufacturing industries — behind machinery and transportation—in spending for plant, equipment and property for overseas operations (see Table I, p. 88).

On an area-by-area basis, U. S. chemical spending runs a strong third in Europe among all other U. S. industries; second in Latin America, and a clear-cut first in Canada and in other areas.

Overseas strength is readily apparent in terms of sales, too. Our chemical industry ranks third, among all U. S. industries, in total export sales, third in terms of expected increases in sales by foreign subsidiaries this year and next.

► **Record Outlays**—Manufacturing companies in all industries are probably setting a new record for capital expenditures overseas this year, with plans for an outlay of $957 million. An increase of 26% over last year, 1959's total exceeds even the $929 million reported in 1957, believed to have been the peak year to date.

Although present plans call for a falling off in capital outlays to $888 next year, these plans may be revised upward substantially. Several companies indicated they were contemplating new facilities abroad but have no firm plans yet.

► **Foreign Subsidiaries** — Reasoning behind this enthusiasm for overseas capital spending is apparent from a comparison of expected export sales of chemicals from domestic plants with expected sales by foreign subsidiaries (Table III, p. 90). Export sales are leveling off, are not expected to rise more than 5% between 1958 and 1960 (4% in 1959, 1% in 1960). Contrast this outlook with an expected

---

This article is based on a few of the highlights from a unique study of foreign operations by U.S. industrial companies conducted by McGraw-Hill's Dept. of Economics.

Dollar figures for capital spending reflect only the plans of companies cooperating in the McGraw-Hill survey. It's estimated, however, that reporting companies account for about three-fourths of overseas capital expenditures made by U.S. manufacturing and petroleum companies.

Export sales figures, though, have been expanded to reflect total commercial export sales of manufactured goods from the U.S. Sales of foreign subsidiaries are presented only in terms of percent changes since no accurate dollar figures are available.

New
CYCLO-TRELL
MECHANICAL
DUST COLLECTORS

These all-new Cyclo-trells can be built to fit any specific job. Available in Types C-10 (10″ diameter), C-24 (24″ diameter), IC (involute Cyclo-trell), ICL (involute Cyclo-trell, lined) and C-24-L (24″ lined). Also available: a new hopper discharge valve.

Write now for your copy of new Bulletin 300 which gives details and illustrations of the new Cyclo-trells and hopper discharge valve.

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REPRESENTATIVES IN PRINCIPAL CITIES OF U. S. AND CANADA

growth in foreign subsidiary sales of 14% in 1959, 13% in 1960, and you can see that the smoothest path to foreign chemical markets lies with manufacture, not shipment, overseas.

All chemical process industries—paper, rubber, petroleum refining, stone, clay & glass—seem to be following this same path. All expect sales of foreign subsidiaries to jump more than 13% between 1958 and 1960. Only paper makers expect to do even as well as chemical makers in export markets, while rubber, petroleum refining and stone, clay and glass companies figure to lose.

▶ **Watch Europe**—As far as geographical concentration of U.S. chemical spending goes, Europe seems to lead the way, taking the play away this year for the first time from Canada and Latin America, which had been the most fertile places for chemical expansion (Table II, this page). For paper makers, though, Canada is still by far the most attractive place for capital investment outside the U.S. For rubber processors, Canada and Latin America will still get more capital outlays than Europe. For stone, clay and glass companies, Canada is way out in front.

(*Continued on p. 90*)

U. S. Firms Spend Freely on Overseas Plants—Table I

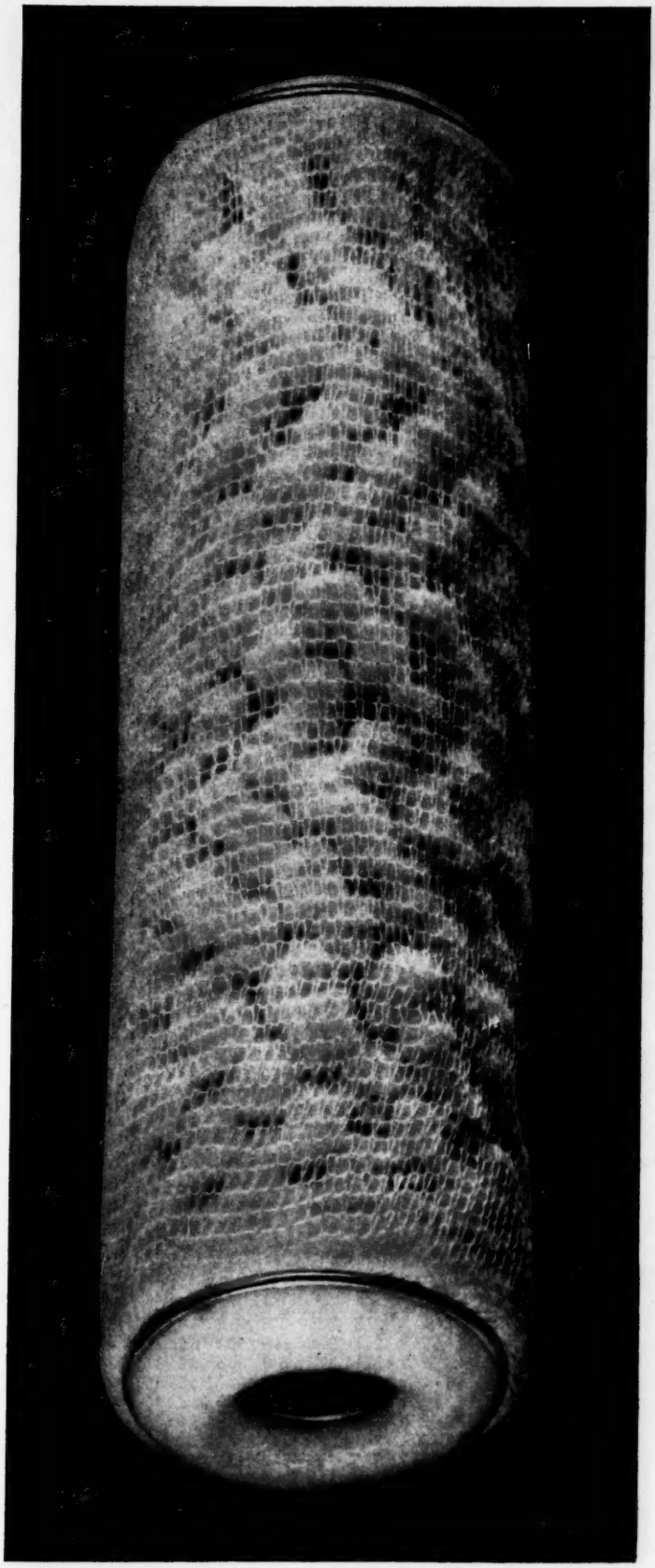
	Million Dollars				
	1957	1958	1959	1960	Total 1957–60
Primary metals*	155	128	133	96	512
Machinery	181	176	208	251	816
Trans. equip. (incl. autos)	219	109	210	187	725
Other metalworking	30	22	33	26	111
Chemicals	148	179	204	175	706
Pulp & paper	61	30	39	25	155
Rubber	62	51	69	67	249
Stone, clay & glass	22	25	18	12	77
Food & beverages	39	34	32	37	142
Misc. mfg. (incl. textiles)	13	9	11	11	44
All manufacturing	930	763	957	887	3,537
Petroleum†	1,575	1,276	1,187	1,246	5,284
Mfg. & petroleum	2,505	2,039	2,144	2,133	8,821

*Includes some mining companies; †includes all operations: exploration, drilling, transportation, refining, etc.

Regional Capital Spending: Europe Lures More Dollars—Table II

	Million Dollars							
	Europe				Canada			
	1957	1958	1959	1960	1957	1958	1959	1960
Chemicals	41	38	70	57	45	55	59	50
Pulp & paper	3	2	3	1	57	18	24	20
Rubber	13	13	11	11	18	18	15	16
Stone, clay & glass	2	4	1	1	12	12	10	6
All manufacturing	358	238	371	418	278	194	220	204
Petroleum*	239	384	344	434	367	297	318	255
	Latin America				Other areas			
	1957	1958	1959	1960	1957	1958	1959	1960
Chemicals	40	49	43	30	21	37	32	38
Pulp & paper	1	9	11	3	neg.	neg.	2	1
Rubber	13	13	29	16	18	18	15	16
Stone, clay & glass	8	7	3	neg.	1	1	4	5
All manufacturing	189	216	231	143	105	113	135	124
Petroleum*	909	477	413	498	60	117	112	59

*Includes all operations: exploration, drilling, transportation, refining, etc.



this NEW cartridge has increased filter life as much as 600%

Tested and proved in plant after plant, on the toughest production runs, the new AFCO "Feutron" filter cartridge has given up to 600% longer life . . . 600% more capacity . . . and a cleaner, more uniform product, day after day.

The AFCO cartridge embodies a new filtration principle, featuring custom-engineered fibers of selected diameter and consistent cartridge density throughout the micron range. The unique construction of the filter media guarantees increased solids capacity, lower pressure drop (which permits a higher filtrate rate), and more uniform performance . . . all of which adds up to a more efficient, economical filter cartridge!

And when you buy the AFCO "Feutron" filter cartridge, you deal *direct* with an American Felt Company salesman. This direct service distribution policy keeps you in personal contact with our engineering and research laboratories . . . offers you the benefit of over 60 years of filtration experience.

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OVER 60 YEARS OF FILTRATION EXPERIENCE

U. S. Export Sales of Manufactured Goods* Waver

	Million Dollars			% Change
	1958†	1959	1960	1958–60
Primary metals	908	854	819	−10
Machinery (no electrical)	2,867	2,953	3,042	+ 6
Electrical machinery	794	794	866	+ 9
Trans. equip. (incl. autos)	1,600	1,456	1,601	0
Other metalworking	683	759	812	+19
Chemicals	1,476	1,535	1,551	+ 5
Pulp & paper	304	298	318	+ 5
Rubber	278	264	264	− 5
Stone, clay & glass	295	284	289	− 2
Petroleum refining	462	448	452	− 2
Food & beverages	812	861	938	+16
Misc. mfg. (incl. textiles)	1,405	1,461	1,490	+ 6
All manufacturing	**11,884**	**11,965**	**12,443**	**+ 5**

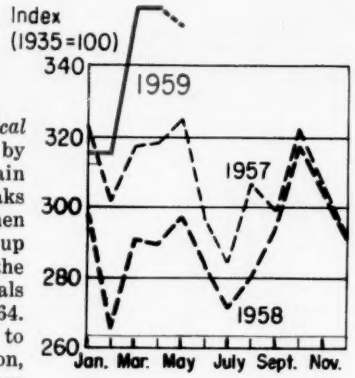
*Excluding agricultural products, military aid and charitable shipments; †U.S. Dept. of Commerce data.

Overseas Subsidiary Sales Stride Ahead—Table III

	% Change 1958–60
Primary metals	+39
Machinery (no electrical)	+15
Electrical machinery	+30
Trans. equip. (incl. autos)	+13
Other metalworking	+12
Chemicals	+27
Pulp & paper	+13
Rubber	+18
Stone, clay & glass	+18
Petroleum refining	+14
Food & beverages	+13
Misc. mfg. (incl. textiles)	+20
All manufacturing	**+16**

For all manufacturing industries as a whole, Western Europe seems destined to keep getting the lion's share of American investment abroad. Foreign capital expenditures of U.S. industrial companies are expanding more rapidly as a matter of fact in Western Europe than in any other area. In 1960, U.S. manufacturers plan to invest more in new facilities in Europe than in Canada and Latin America combined—47% of their total spending abroad.

Chemical Use Index Breaks the 340 Barrier



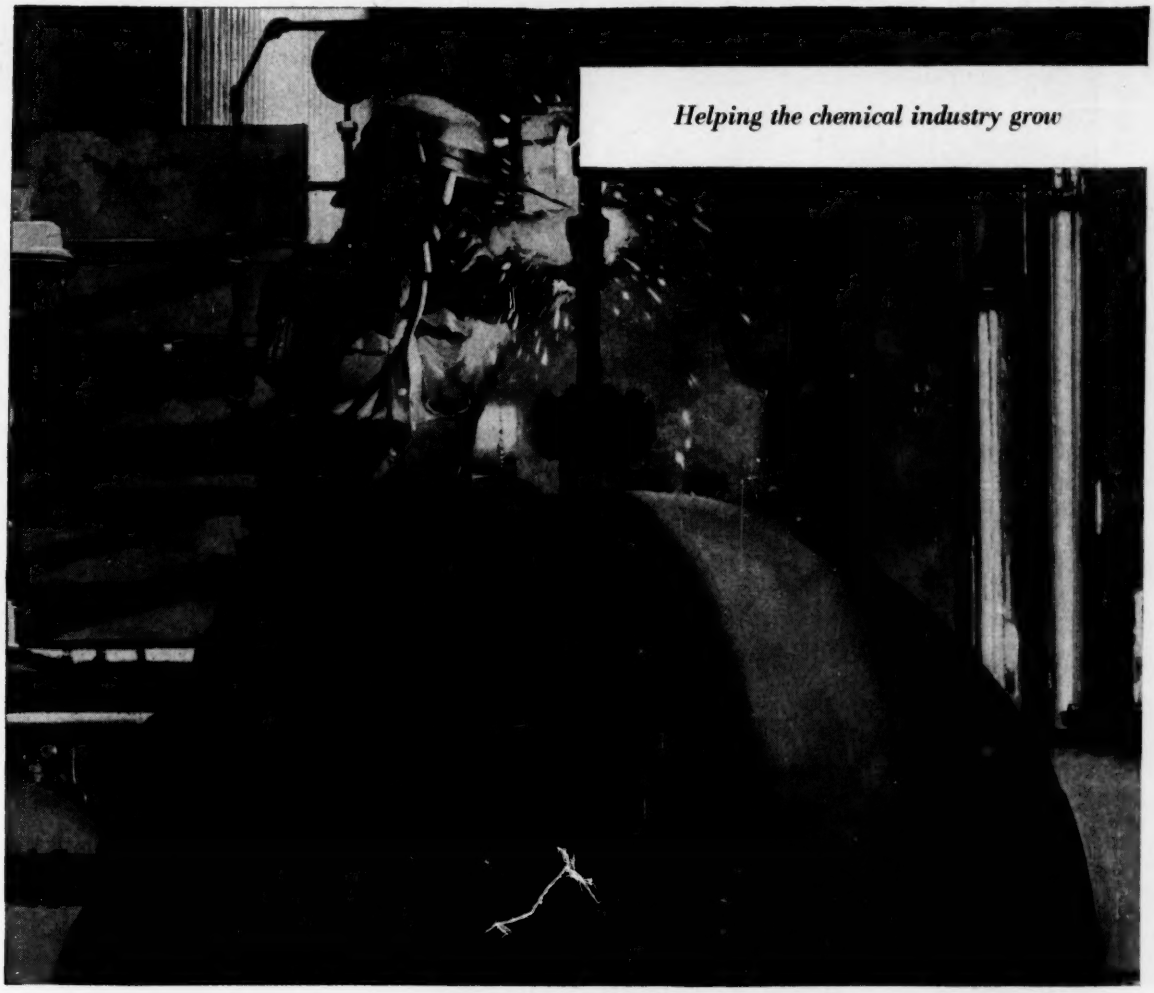
Mirroring 1959's robust chemical sales, *Chemical Engineering's* Index of Chemical Consumption by Industries hit all-time highs of 355 in March, again in April and 351 (est.) in May. These new peaks far outreach levels for the busy days of 1956 when the index made 340, also in March. It all adds up to further evidence—spectacular evidence—of the strong recovery-from-recession staged by chemicals that we told you about in our May 4 issue, pp. 60-64.

Incidentally, we promised in that same issue to give you soon a breakdown of chemical consumption, industry by industry, for the past decade. So here it is . . .

. . . A Ten-Year Look at Chemical Use by Industries

	Coal Products	Explosives	Fertilizers	Glass	Iron & Steel	Leather	Paint & Varnish	Paper & Pulp	Petroleum Refining	Plastics	Rayon	Rubber	Textiles	Total
1949	9.6	7.2	52.4	18.1	12.0	4.2	21.9	22.3	21.5	9.6	23.1	4.8	9.2	216
1950	10.3	8.4	54.4	21.7	14.8	4.4	25.8	26.7	22.6	16.0	30.4	6.0	11.4	252
1951	11.2	8.5	56.2	22.3	16.1	4.0	27.2	33.1	25.7	17.3	30.6	6.2	11.5	267
1952	9.9	8.7	59.9	22.2	14.3	4.3	26.7	28.6	25.8	16.9	27.3	6.0	10.5	261
1953	11.9	9.0	58.6	23.3	17.1	4.2	28.1	30.3	27.7	18.6	28.7	6.3	10.6	274
1954	10.3	8.1	60.4	23.6	13.5	3.9	27.2	31.3	27.5	19.1	26.1	5.8	9.7	266
1955	12.1	9.2	65.1	25.4	17.9	4.2	30.4	35.1	29.6	23.1	30.0	7.2	10.4	299
1956	11.2	10.8	68.2	26.0	17.6	4.1	31.9	37.1	31.5	24.3	27.6	6.7	10.3	307
1957	11.3	10.8	67.5	26.7	17.2	4.1	32.1	36.4	31.4	24.5	27.4	6.8	9.6	306
1958	8.0	9.7	67.2	26.7	13.0	4.1	32.1	36.4	29.9	24.7	23.6	6.2	9.2	291
1959*	10.0	10.3	79.1	26.5	19.0	4.3	34.4	39.0	30.5	31.6	26.3	7.1	10.2	328

**Chemical Engineering* estimate.



Atop a storage tank a helmeted welder makes a connection—and still another giant processing plant will soon join the ranks of America's ever-expanding chemical industry. Painting by Stanley Meltzoff.

The Economy of Experience

Operating within established budget limits in the design and construction of a processing plant, large or small, calls for experience of the highest order. Only this can effect cost and timesaving advantages—and still assure the smooth teamwork needed in design, purchasing, expediting and construction.

Making experience pay dividends to our clients has been demonstrated on a wide variety of chemical production and processing plants for some of the country's largest producers.

Let our skills and creativity augment the engineering facilities of your own organization. Profit by the advantages of United Engineers' 75-year background of experience.

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CHEMICAL PRODUCTS

EDITED BY FRANCES ARNE

Epoxy, not Brick, Lines and Acid-Proofs Stack

As good as new after a year, epoxy resin is doing a stack-lining job of a kind ordinarily assigned to brick. On one of the country's highest stacks rising 613 ft. at Kaiser's aluminum reduction plant at Ravenswood, W. Va., it performs low-temperature, acid-resistant service.

Called Coroline, the coating is manufactured and was applied during construction of the monolithic concrete stack by Ceilcote Co. As each successive increment of the concrete was completed, the acid-resistant Coroline coating was applied.

At $2-$2.50/sq. ft., cost of lining the stack's 60,000-sq. ft. interior was $3.50-$5 less than cost of brick lining.—Ceilcote Co., Cleveland.

Catalyst

Improves removal of N and S from catalytic reforming feedstocks.

A new nickel-containing catalyst is specifically designed to give superior results in the pretreatment of catalytic reforming feedstocks for contaminant removal, especially nitrogen and sulfur. It can also be used in the treatment of intermediate oils for improved color, storage stability and sulfur reduction. Called Type S-4 Hydrobon, it is fully regenerable.

Type S-4 has several advantages as compared with similar types previously used. Its activity in nitrogen removal is said to be almost twice that of the earlier catalysts. Increased nitrogen removal from feedstocks gives definite improvements in catalytic reforming. Increased activity in sulfur removal results in improved product quality, even when processing poorer grades of feed stocks.

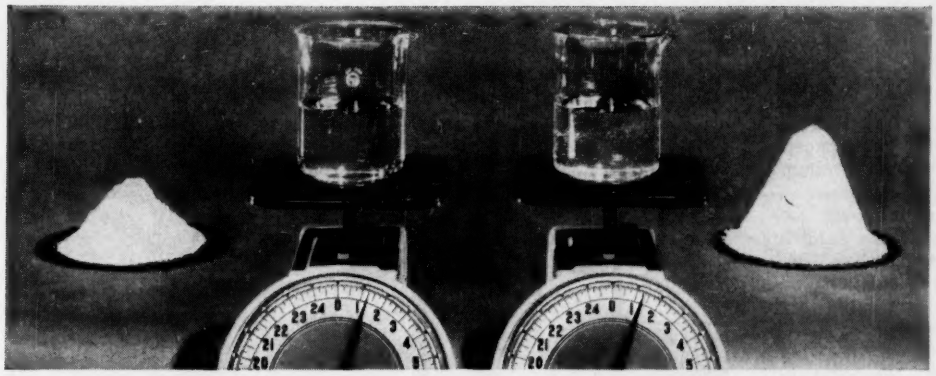
Other advantages of the new catalyst include decreased catalyst requirement — resulting from lower catalyst density— more heat, stability, longer life. **—Universal Oil Products Co., Des Plaines, Ill. 92B**

Adhesives

New patching cements for filter fabrics.

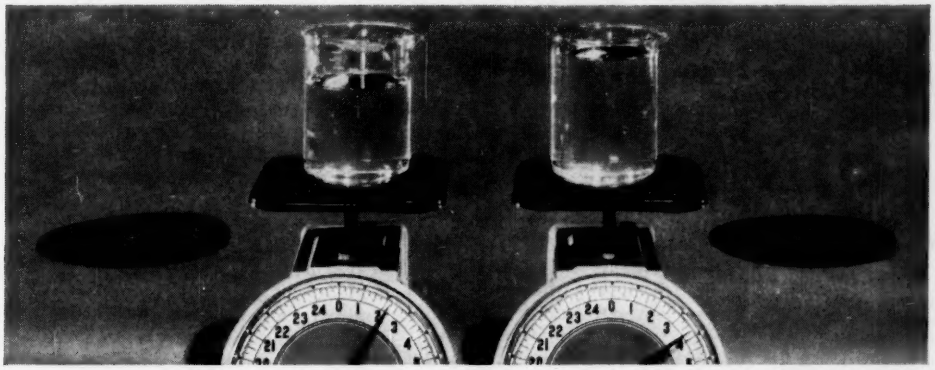
Called Vicel, a new solvent-type cement patches tears and holes in press cloths, centrifuge bags, and rotary vacuum filter cloths. This dries by evaporation of the solvent leaving a tough film of acrylonitrile-vinyl chloride copolymer.

Patch has excellent resistance to concentrated acids and alkalies. It will not leach out,



Before

Weight and temperature of water (68°F.) in each beaker is identical. But the two stacks of chemicals are different — *3 times more* potassium carbonate (right) than sodium carbonate (left).



After

adding each chemical to a beaker, both are completely dissolved. You can *see* the greater solubility of potassium carbonate in the higher fluid level and heavier weight of the righthand beaker. It has *3 times more* carbonate in solution than the other beaker containing sodium carbonate.

Get more carbonate in solution... more soluble reaction products with SOLVAY POTASSIUM CARBONATE

By switching from sodium carbonate (soda ash) to more soluble Solvay® Potassium Carbonate, you can save on handling, storage and packaging with more efficient, more concentrated solutions. You also get more highly soluble reaction products—for superior performance in many applications.

These features are important to consumers and manufacturers of liquid soaps and detergents; producers of special boiler and other cleaning compounds; chemical and textile processors.

You can obtain Solvay Potassium Carbonate in 3 handy forms—99-100% calcined, 83-85% hydrated and 47% liquid. Mail coupon for free sample and further information.

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so can be used in filtration involving foodstuffs, pharmaceuticals, and high purity chemicals.

A two-component epoxy cement, called Nycel, is said to give exceptional strength, fast curing time and excellent resistance to acids, alkalies and solvents. It has tensile shear strength of 2,000 lb./in. when cured at room temperature. Especially recommended for centrifuge bags, press cloths and dust collection bags, it shows excellent adhesion even to monofilament yarn fabrics.—**Technical Fabricators, Inc., Nutley, N. J.** **92C**

Organic Acid

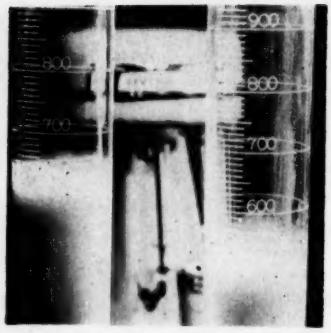
To serve as driers for coatings, plasticizers for PVC.

Iso-decanoic acid (mixed isomers) is now available in commercial quantities. The new acid is a complex mixture of methyl-substituted, ten-carbon, aliphatic, monocarboxylic acids having relatively little alpha substitution. The principal isomers are trimethylheptanoic and dimethyloctanoic acids.

The acid has a high boiling point, and is soluble in organic solvents, but not in water. It will react to form salts, esters, amides, amines, etc. Because of its chemical nature, it has potential applications similar to those of coconut fatty acids (caprylic, capric, and lauric) and tall oil-derived fatty acid (pelargonic). Being a primary product, iso-decanoic acid is free from fluctuating supply and price.

Potential uses for the acid or its derivatives: driers for varnishes and enamels, plasticizers and stabilizers for polyvinyl chloride resins, alkyd resin modifiers for nitrocellulose automotive lacquers and alkyd-amine resin appliance finishes, boiler feedwater defoamers, synthetic lubricants for jet aircraft, functional fluids, fungicides, detergents, emulsifiers, corrosion inhibitors.

Its available at 32¢/lb. in tank car lots.—**Union Carbide Chemicals Co., New York.** **94A**



Latex for Paper Coat

Compared to conventional latex, left, foams less upon agitation.

A new latex for pigmented paper coatings has greater adhesive strength and less foam. Improvements over conventional styrene-butadiene latices have been obtained by carefully adjusting the emulsifier content and by fortifying the polymer during polymerization.

Known as Dylex Latex KCD-154, it is reported to have as much as 50% increased film strength, which results in better pigment binding. There is considerably less foam formed initially during agitation with other coating ingredients, and this minimal foam dissipates at a much more rapid rate than in conventional latex. Compatibility with various clays and pigments as well as with starch and casein, is excellent. — **Koppers Co., Pittsburgh, Pa.** **94B**

Intermediates

Ethylene-maleic anhydride copolymers for dispersants, surface coatings.

A new series of water soluble ethylene-maleic anhydride copolymers which can be furnished either as an anhydride, free acid or amide-ammonium salt, is available in commercial quantities.

The base copolymer, because of its polyanhydride structure, offers unique possibilities as a building block for chemical synthesis. A wide range of derivatives, such as transparent film formers, polymeric liquids, waxy solids and polyampholytes can be prepared by proper choice of reactants.

Each of the resins in the series is available in three molecular weights—low, intermediate and high—as fine, free-flowing white powder. Cross-linked versions of the anhydride and amide-ammonium salt are also available.

Physical properties of the linear resins, all of which come as white powders, are shown in the table, next page:

Newsworthy Chemicals

	Page Number is also Reader Service Code Number
Epoxy, not brick, lines and acid-proofs stack	92A
Catalyst removes N and S from reforming feedstocks	92B
New patching cements for filter fabrics	92C
Iso-decanoic acid now commercially available	94A
New latex creates less foam in paper coat formulating	94B
New intermediates for dispersants, surface coatings	94C
Sulfur tetrafluoride synthesized and commercialized	96A
Epoxy for dip-without-drip encapsulation	96B
Polyethylene for stress resistant blow moldings	96C
Gelling agents for a variety of grease types	96D
Low-formaldehyde thermoset for low-odor textile finish	96E

For more details, use Reader Service Card

TURBO-COMPRESSORS AND BLOWERS

2500 cfm and up

By Eugen P. Eicher, M.E., Brown Boveri Corp.

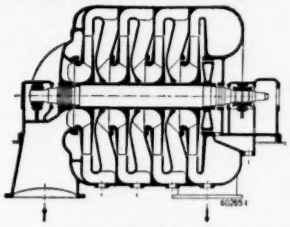
BROWN BOVERI

Brown Boveri offers complete compressor sets including compressor, choice of drives and all auxiliary equipment. Brown Boveri manufactures all the components, assembles and tests the complete sets in their own workshops and assumes full responsibility for the complete unit.

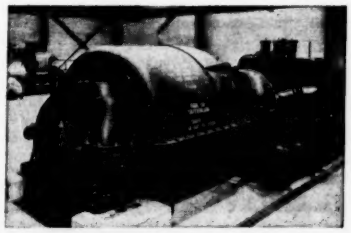
Compressors include a full range of centrifugal and axial types. Drives include steam turbines, gas turbines, expander turbines and electric motors. (Where hot waste gases are available, for example, a combination of motor-generator and exhaust-gas expander turbine drives has reduced power costs 60 to 70%.) Auxiliary equipment includes gear sets, pressure and volume regulators, air and gas coolers and complete electrical control systems.

Brown Boveri compressor sets are used by many leading U. S. companies and are backed by engineering skill, product reliability, and complete U. S. service staff and facilities.

2500 to 175,000 cfm at up to 60 psi* Uncooled centrifugal blowers



Four-stage centrifugal compressor.



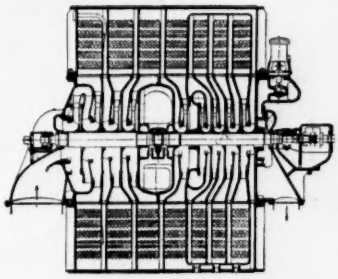
One of two 40,000 cfm centrifugal blowers with steam turbine drive in a copper conversion plant, Arizona.

First developed by Brown Boveri. Advantages over reciprocating compressors in the above ranges: lower cost, higher efficiency, less maintenance, less floor space and *clean, oil-free air.*

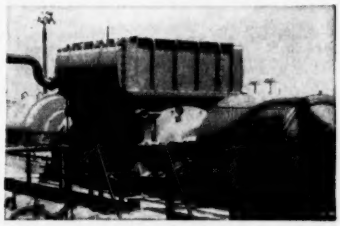
Standard designs are for air or non-poisonous, non-corrosive and non-explosive gases. Stainless steel impellers, shafts, etc. are available for corrosive gases. High-pressure casings and oil type sealing glands are available for higher pressures.

Applications: Blast furnaces, converters, coke ovens, gas distribution, process air and gases, air separation plants, sewage aeration, tunnel ventilation.

5000 to 80,000 cfm at 60 to 120 psi* Internally-cooled "Isotherm" centrifugal compressors



Nine-stage "Isotherm" compressor with anti-surge power-recovery turbine.



"Isotherm" compressor driven by a synchronous motor (left) and a waste-gas recovery turbine (right) at a California chemical plant.

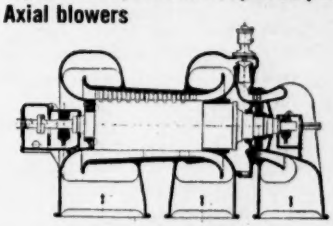
Highest inherent efficiency. Ten basic models with 6 to 9 stages per casing. Impeller diameters from approx. 1 ft. to 4 ft. The larger models include a built-in power-recovery turbine to allow running at loads below the surge limit.

Stainless steel impellers, shafts, etc. are available. For discharge pressures higher than 120 psi, "Isotherm" compressors are followed by an uncooled centrifugal compressor or other booster.

Drives: Four-pole synchronous motors are generally preferred for 1500 hp and larger units, other type motors for smaller sizes. Speed-increasing gears are used with all motor drives. Variable-speed steam or gas turbines are direct coupled.

The reliability of "Isotherm" compressors is proved by hundreds of installations in mines, shipyards, chemical process plants, air liquefying plants, aerodynamics laboratories.

10,000 to 500,000 cfm at up to 80 psi* Axial blowers



Ten-stage axial compressor with anti-surge power recovery turbine.

Axial blower, steam turbine drive, supplying 70,000 cfm of air for a blast furnace.

Substantially more efficient than centrifugal units for large air volumes where adequate pressure can be delivered with a single unit and without cooling. The higher efficiency allows smaller and better drives and lower cost. A power-recovery turbine may be built in to permit operation at volumes below the surge limit.

Drives. Steam turbines allow simple, automatic control through Brown Boveri pressure-oil governors with pressure or volume regulator. Brown Boveri gas turbines and electric motor drives of all types are also available.

Applications: Gas turbines, wind tunnels and chemical plants. In Europe, Brown Boveri axial compressors driven by gas turbines are widely used for blast furnace air with substantial power savings.

**Capacities for single machines. Higher discharge pressures can be obtained by combining various types of equipment in series.*

BROWN BOVERI

U. S. Sales and Engineering: Brown Boveri Corp., Dept CE9, 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. cities.

Properties

	Anhydride	Acid	Mixed amide-Ammonium Salt
Density (lb./cu. ft.)	20	37	35
pH 1% aq. soln.	2.35	2.35	8.6
Softens, C.	170	155	151
Decomposes, C.	247	250	250
Solubility			
Water	Ins.	Sol.	Sol.
Carbon tetrachloride	Ins.	Ins.	Ins.
Methyl ethyl ketone	Ins.	Ins.	Ins.
Acetone	Sol.	Ins.	Ins.
Dioxane	Ins.	Sol.	Ins.
Pyridine	Sol.	Ins.	Ins.
Dimethyl formamide	Sol.	Sol.	Ins.
Benzene	Ins.	Ins.	Ins.
Hexane	Ins.	Ins.	Ins.
Ethyl acetate	Ins.	Ins.	Ins.
Ethanol	Ins.	Ins.	Ins.

The series is said to have been tested for many applications including adhesives, dispersants, suspending agents, controlling crystal formation, foundry resins, surface coatings, textile sizing and thickeners for aqueous systems such as water-based paints, cosmetics. — **Monsanto Chemical Co., Springfield, Mass.** 94C

Sulfur Tetrafluoride

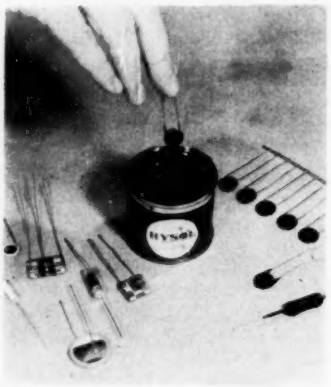
Only recently synthesized, its availability opens way to new F compounds.

A unique chemical compound, whose very existence was doubted in scientific circles until recently, has been placed on the market in development quantities.

The new product, sulfur tetrafluoride, is a reactive gas which, unlike other reagents, possesses the ability of replacing oxygen with fluorine in many chemical compounds. Opening up a whole new range of selectively fluorinated products, sulfur tetrafluoride appears to be of particular interest in pharmaceutical products, where addition of fluorine has been known to result in drugs of high potency. The ability of fluorine to cause or modify biological activity of other chemicals is expected to lead to better insecticides and herbicides.

Other uses of the fluorinating agent might be in production of improved weather-resistant finishes, and oils, films, plastics, and elastomers with high thermal stability and resistance to oxidation. The low surface energy characteristic of many fluorinated compounds also suggests use of sulfur tetrafluoride in manufacture of surface active agents, water and oil repellents, and lubricants.

Studies show sulfur tetrafluoride can be reacted effectively with a variety of carboxylic acids and carbonyl compounds, including aldehydes, ketones, and quinones to produce new fluorine-containing products or simply the manufacturing processes involved in existing products. — **Du Pont Co., Wilmington, Del.** 96A



Epoxy Compound

Thixotropic mix for dip-without-drip encapsulation.

A new epoxy compound has been developed for encapsulating, by dipping, small electrical components such as ceramic wafer capacitors, resistors and small transformers. Identified as Hysol 10-80, the black thixotropic material produces an even non-dripping coat on pieces up to 1-in. cube.

The mixture is quite viscous. However, when some relative motion is produced between the system and the part being dipped, the viscosity at the part reduces sharply so that the compound can flow evenly over the part. On withdrawal, the viscosity rises so that no dripping occurs, even at 160 C. cure.

The compound has passed the temperature and immersion cycling tests set down by MIL-C-11015A "Capacitors, Fixed Ceramic Dielectric." The 10-day moisture resistance test was passed averaging 100,000 megohms against the specified minimum of 1,000 megohms. — **Houghton Laboratories Inc., Olean, N. Y.** 96B

Briefs

Polyethylene resin, Poly-Eth 5104, is said to be ideally suited for blow molding applications. A .922 density material with a melt index of 1.5, it has good stress crack resistance, low permeability and lack of residual odor.— **Spencer Chemical Co., Kansas City, Mo.** 96C

Line of gel-tested soaps — tailored to gel mineral oils of a wide viscosity range to form various grease types— has been developed. Aluminum Stearate GG-200 and GG-250 are excellent gelling agents and allow reduction in stearate requirements for a given grease consistency. Aluminum stearate GG-300, and intermediate gelling soap, produces a smooth, stable grease of moderate consistency in most base oils.— **Heyden Newport Chemical Corp., New York.** 96D

Low-formaldehyde thermosetting resin is said to end textile finishers' formaldehyde odor problems, even permitting some to eliminate the afterwash process. Called C-Tron, it imparts a high quality crease and shrink resistance to both natural and synthetic fabrics. — **Crown Chemical Corp., Providence, R. I.** 96E

For More Information . . .

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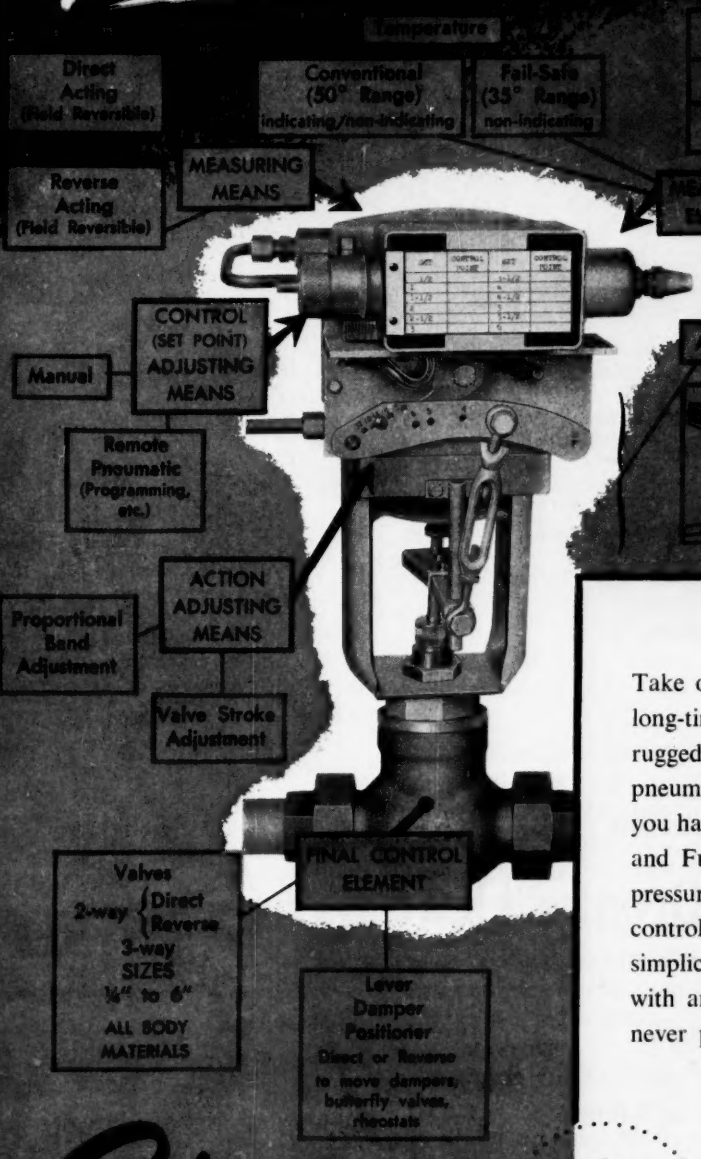
FultroMatic

The Greatest Flexibility in Powered Controllers!



Take our famous self-ops . . . long-time standards of simplicity, ruggedness and efficiency . . . add pneumatic or electric power, and you have our great new FultroMatic and FultroLectric series of pressure and temperature controllers! Same durability, simplicity, economy . . . but with an almost limitless flexibility never possible before!

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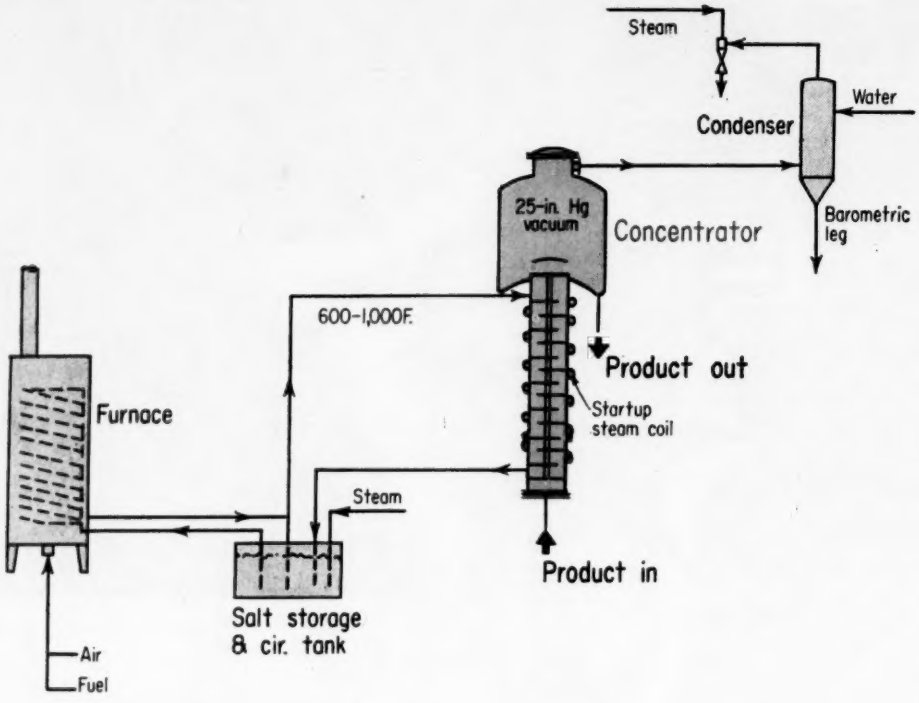


For Continuous Evaporation . . .

Concentrator Breaks Heat Barrier

Commercially proved unit can continuously dehydrate various solutions at temperatures as high as 1,000 F.

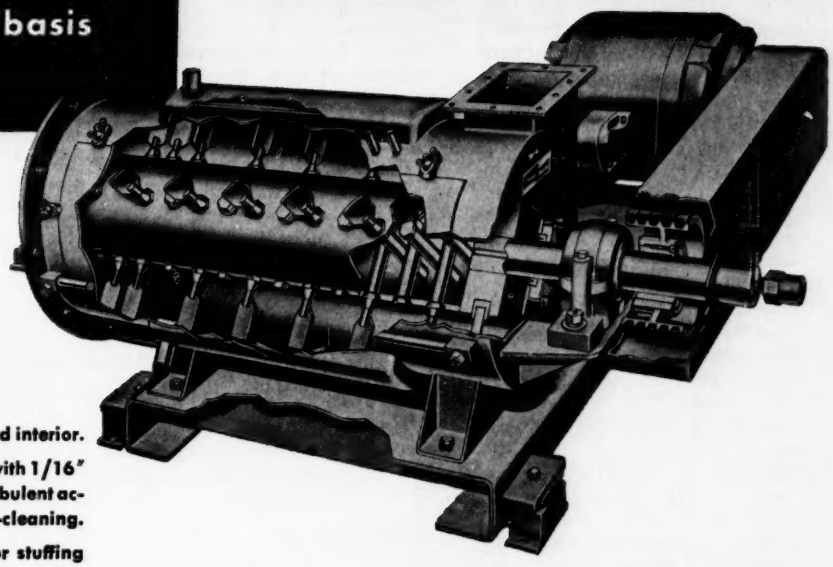
Nucleus of many future evaporation processes may be Buflovak Equipment Div.'s newly available concentrator. This industrial tool opens the way to precisely controlled, high-temperature dehydration of sizeable volumes of many different flowing solutions.

Briefly, the concentrator consists of a vertical, long-tube, single-pass heat exchanger, fitted on top with a cylindrical liquid-vapor separator. Adaptable to either molten-salt or direct-fired methods of shell-side heating, the unit can handle concentration processes requiring temperatures from 600 to 1,000 F., and final concentrations above 99%.

▶**Prime Target: Caustic**—Although the concentrator will fill the bill for a wide variety of evaporative operations—e.g. calcium chloride, KOH, etc.—Buflovak sees greatest potential

There's one sure way to get intimate mixing of dry and semi-dry material on a continuous basis

Strong Scott TURBULIZER®



EXCLUSIVE TURBULIZER FEATURES

- Heavy steel shell with machined interior.
- Paddles revolve at high speed with 1/16" clearance to shell, creating a turbulent action that makes Turbulizer self-cleaning.
- Choice of lip type, air purge or stuffing box seals. All are of split construction for quick disassembly. (Lip type seal shown.)
- Hinged door is machined as an integral part of the shell giving a perfectly smooth interior surface.
- May be equipped with jacket up to 150 PSI for heat transfer medium.
- Hollow rotor shaft for heat transfer medium gives added temperature control.
- Inlet nozzles available for adding liquids.
- Quick acting heavy lug type catches—no nuts or bolts to remove.
- Tangential inlet and discharge prevent material hang-up.
- Heavy duty outboard bearings.
- Rotating joints for easy connection to heat transfer medium source.

The Turbulizer solves many dispersion problems in the chemical and food industries. Adjustable-pitch paddles, revolving at high speed, result in the combined action of turbulence, shear and impact providing intense dispersion. These actions can be varied to obtain desired results on a specific material.

A completely smooth inner surface with 1/16" clearance paddles, assures thorough mixing, eliminates material hang-up, leaves no dead pockets of unmixed material and provides a self-cleaning operation.

In addition to the numerous features shown here, advantages of the Turbulizer include better product uniformity, increased production, plus lower labor, installation and up-keep costs.

Write for complete details...

Please send information on the Turbulizer

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

The Strong Scott Mfg. Co.

451 TAFT STREET NE • MINNEAPOLIS 13, MINNESOTA

EQUIPMENT DESIGNED FOR BETTER PROCESSING

for it in continuous dehydration of NaOH solutions.

Until the mid-1940's, all anhydrous-caustic producers used traditional batchwise methods. These involved long periods of boiling in direct-fired, cast steel pots.

Then a few producers began to swap their pots for continuous Dowtherm-heated, long-tube evaporators (*Chem. Eng.*, Feb. 1954, p.183). But to get top-quality product, evaporation temperatures must run upward of 700 F. At these levels, thermal decomposition of Dowtherm can become somewhat of a problem.

▶ **Bypass One Difficulty**—Equipment fabricators and process designers looked for ways to get around this difficulty. In early 1959, it was reported that another continuous process, substituting direct firing for Dowtherm, was being readied for commercialization by Dow Chemical (*Chem. Eng.*, Jan. 26, 1959, p.35).

Buflovak's announcement that their concentrators are now available is the latest development in this chain of events. With these units, there is no danger of heat-transfer-medium breakdown below 1,000 F. According to W. D. Kohlins, division manager, the concentrator makes batch methods obsolete. In explanation he says, "Being a completely enclosed and continuous system, no contamination can reach the product, production is faster, and labor requirements are lower than with a conventional pot line."

▶ **Proved in Service**—For over a year now, the first commercial Buflovak concentrator has been in service at Canadian Industries, Ltd.'s caustic-finishing plant in Shawinigan Falls, Que. A. W. Eckstrom, designer of the evaporator, claims that this unit has performed well up to expectations.

Another salt-heated unit is under construction for a second, unidentified Canadian firm, and a third is located at a Semet-Solvay plant in Moundsville, W. Va. Also, a direct-fired concentrator is now undergoing final stages of development.

▶ **How It Works**—In typical caustic operation (see illustration), molten DuPont HTS salt from the furnace enters the top of the exchanger's shell at 750-800 F., and flows downward to an exit line leading to a salt storage tank. Cross baffles assure proper salt velocity across the tubes.

Caustic solution (73%, 260 F.) travels upward in a single pass through the 20-ft. tubes, and rises into the separator. Water vapor from the separator condenses at about 25 in. Hg vacuum in another vessel. Anhydrous caustic (99.8%) continuously discharges at 710 F. to a flaker or drum packer.

▶ **Custom Production**—Buflovak will custom-build concentrators on order in any capacity above 20 tons/day. Depending on application, materials of construction range from carbon steel to Inconel. Price tag for a 150-ton/day unit, including salt heater, storage tank, condenser, etc. falls roughly in the vicinity of $150,000.—**Buflovak Equipment Div., Blaw-Knox Co., Buffalo, N. Y.** 98A

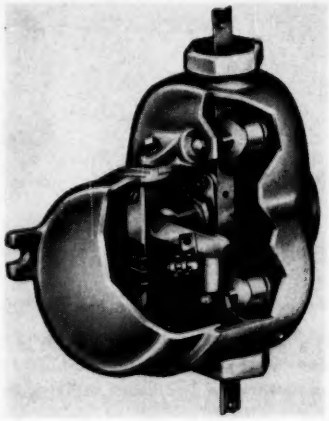
Transmitter

Responds to d.c. signals from any sensing element.

Microsen Series E710 transmitting potentiometers convert low-level d.c. electrical signals to proportional 1.0-5.0 milliamp. d.c. signals for transmission to distant measurement and control systems.

Applicable to any sensing element producing a d.c. signal, the instrument's semi-null-balance, resistance-bridge design results in instant, sensitive response to input change. Variations in ambient temperature, power supply or line resistance are automatically compensated. Modular construction makes field replacement possible with only a screw driver.

Within any measurement function, replacement of a range card changes range. Measurement functions can be changed merely by substituting an appropriate reference standard and range card. — **Manning, Maxwell & Moore, Stratford, Conn.** 100A



Alarm Control

Warns of broken or slack tape in tank-gaging system.

New Slack Take alarm controls enable tank gagers or operators of remote gaging systems to immediately detect a broken tape or any abnormal slackening of a tape at the time of reading. Personnel can thus reject the reading at the receiver, or ignore it at the gage head.

Construction is quite simple. An idler pulley that rides against the gage tape actuates a mercury switch if the tape breaks or becomes abnormally slack. Either visual or audible alarms can be wired into the switch.

Field installation to existing pulse-code telemetering systems is quite easy and inexpensive, according to the manufacturer. —**Vapor Recovery System Co., Compton, Calif.** 100B

Continued on p. 102

For More Information . . .

about any item in this department, circle its code number on the

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postcard (p. 225)

LIQUID NITROGEN

...AT THE TOUCH OF A BUTTON

Supplies laboratory or plant needs swiftly and economically

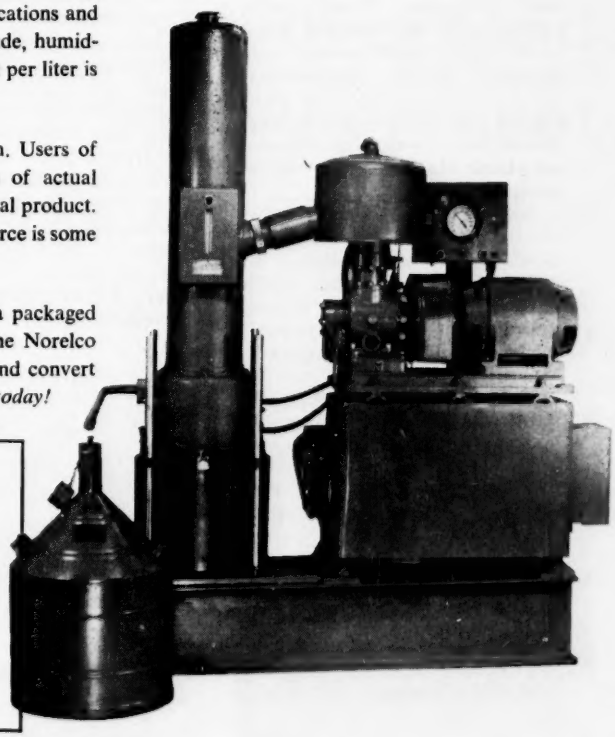
Convenience is unmatched. A ready supply of liquid nitrogen always available —literally at the touch of a button. Supply is obtainable days, nights, weekends or holidays – it is not subject to outside influences over which you have no control such as routing or delivery schedules.

The Norelco Liquid Nitrogen Generator consists of a single atmosphere separation column that employs a Norelco Gas Liquefier as the nitrogen condenser. Operating as a completely integrated and self-contained system, the generator produces pure liquid nitrogen from air. *An oil-free product is assured since neither nitrogen nor air ever comes in contact with oily surfaces of working parts.* There are no moving parts in nitrogen separation column. The Norelco Nitrogen Generator does not require expert supervision for operation. Automatic controls provide continuous reliable service.

Startling economies are available with the Norelco Liquid Nitrogen Generator. The unit produces an average of six liters of pure, (99.5%) liquid nitrogen per hour over an uninterrupted period of up to 200 hours. (Production figures are based on average locations and operating conditions. Output will vary according to altitude, humidity, temperature, etc.) On a regular production basis, cost per liter is but a small fraction of most existing commercial rates.

Vaporization losses are reduced to an absolute minimum. Users of moderate quantities of liquid nitrogen order in excess of actual requirements in order to insure adequate supply of this vital product. Losses are considerable, particularly if the commercial source is some distance away.

The Norelco Liquid Nitrogen Generator is supplied as a packaged unit ready for immediate installation. Present users of the Norelco Gas Liquefier may add the nitrogen separation column and convert their unit to liquid nitrogen production. *Send for details today!*

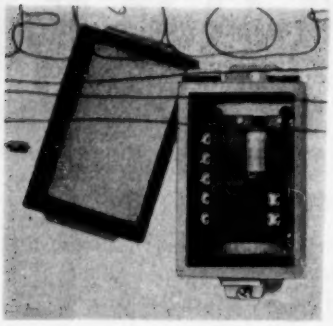


FEATURES

1. Low Cost
2. Fresh supply always available
3. Clean, *oil-free* product
4. High purity product
5. No evaporation or storage problems
6. No compressed air necessary
7. No expert supervision required
8. High production yield
9. Automatic controls for continuous reliable service

NORTH AMERICAN PHILIPS COMPANY, Inc.

Cryogenics Division 100 STEVENS AVENUE, MOUNT VERNON, N. Y.



Temperature Monitor

Senses temperature along its entire length.

Rather than sensing temperatures only at several predetermined points, a new temperature detector is responsive to thermal conditions over its entire length. In essence, it is a multipoint monitor covering an infinite number of points.

Operation is based on the temperature-resistance relationship of selected eutectic salt mixtures. These salts, packed into an Inconel tube, surround a nickel center conductor. When temperature reaches the set point, a short circuit between the center conductor and outer tube actuates an alarm via a sensing control unit.

Sensing tubes bend to practically any desired configuration, making them useful for difficult locations and equipment having irregular shapes. Standard elements connect into series to form lengths of several hundred feet and, in some systems, several different temperatures are detectable. Presently available units cover temperatures of 255, 310, 400, 575, 765, 900, 1,050, 1,200 F. **Fenwall, Inc., Ashland, Mass. 102A**

Spray Nozzles

Made of hard rubber, units resist corrosive liquids.

Hard rubber is the material of construction for a new line of atomizing nozzles designed for corrosive-liquid spraying applications. The nozzles produce a hollow-cone spray pattern.

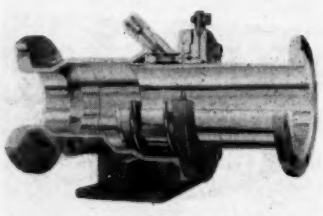
Capacities range from 1 to 26 gph. based on operation at 40 psi. Atomization is accomplished through hydraulic pressure alone.—**Spraying Systems Co., Bellwood, Ill. 102B**

Motor Vibrator

Prevents sticking, arching or bridging.

Ideal for heavy-duty applications requiring continuous flow of bulk materials, Model RC2-50 produces straight-line vibration in any direction. The new dual-motor vibrator operates on a rotating eccentric-weight principle, and features adjustable eccentrics.

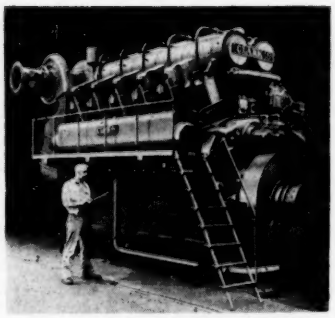
Variable impact range is 640-2,200 ft.-lb. Impact change requires only a matter of minutes. Operation is practically noiseless, according to the manufacturer.—**Cleveland Vibrator Co., Cleveland, Ohio. 102C**



Expansion Joint

Single, positive-stop fitting lubricates packing.

Called Ram-Pak, a new expansion joint features a dispersion ring that assures complete and uniform lubrication of the plastic packing material. Plastic packing can be replaced without taking the joint out of service. An internal guide acts as inward and outward limit stop to prevent the slip from being pulled out of the body. When the guide is in contact with the lubricant dispersion ring, full pressure thrust transfers back to the body.—**Adsco Div., Yuba Consolidated Industries, Inc., Buffalo, N. Y. 102D**



Gas Engine

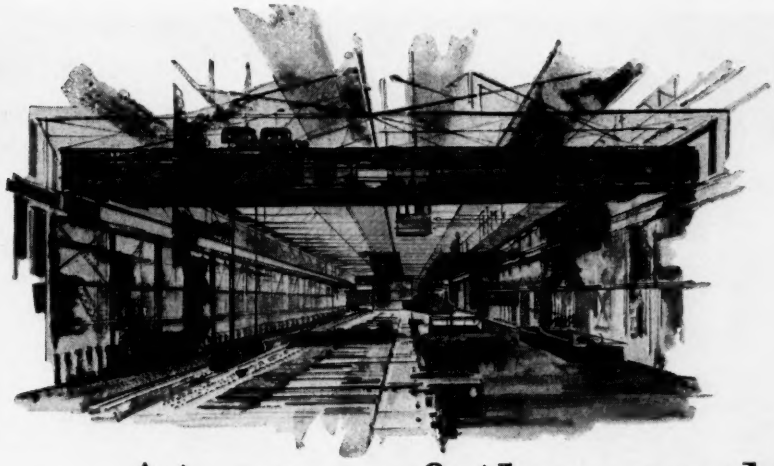
Two-cycle machine has low fuel consumption. Compact.

New, V-type, turbocharged, two-cycle gas engines are available for drive applications with centrifugal compressors, power stations and pumps. Designated Model TPV, the engines come in three sizes—10, 12, and 16 power cylinders with ratings of 4,000, 4,800 and 6,400 bhp., respectively.

Several years in development, Model TPV combines low fuel consumption with the reliability and low maintenance costs inherent in 2-cycle design. Thermal efficiency is approximately 40%; bmep. is 110 psi. Compared to other engines having the same number of cylinders, the new product produces up to 77% more horsepower per square foot of floor space.

Other features include aluminum main and connecting-

EQUIPMENT NEWS
Continues on . . . Page 200



At one of the world's largest integrated steel companies, over 1400 Farval systems unfailingly deliver proper lubrication to each vital bearing on 700 overhead traveling cranes. When equipment is Farvalized . . . maintenance is kept at a minimum.

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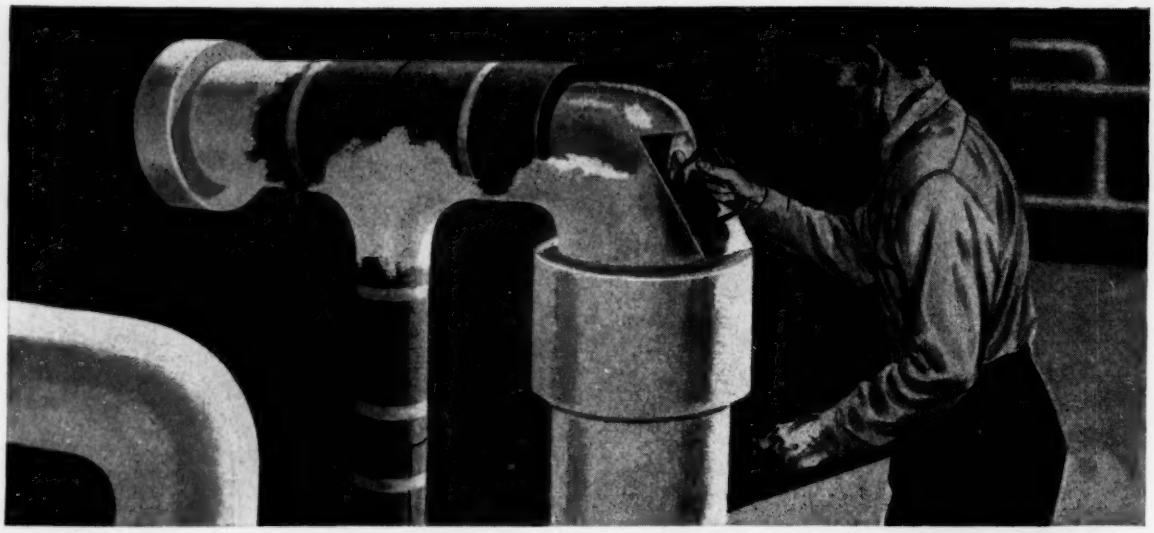
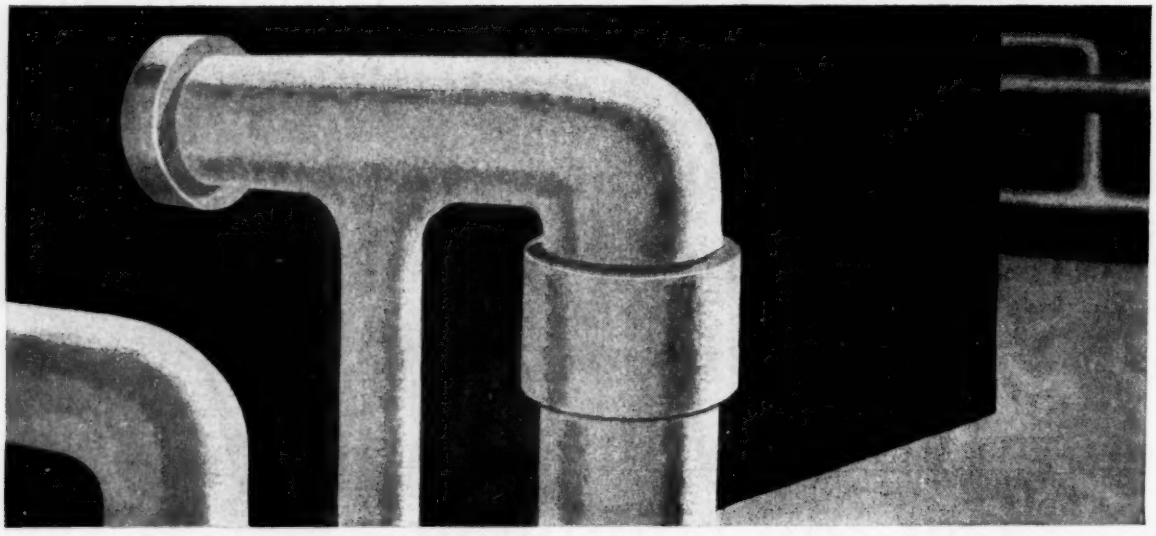


ONE QUICK APPLICATION INSULATES, PROTECTS, FINISHES!



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ONE-COTE CEMENT

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

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Since 1843

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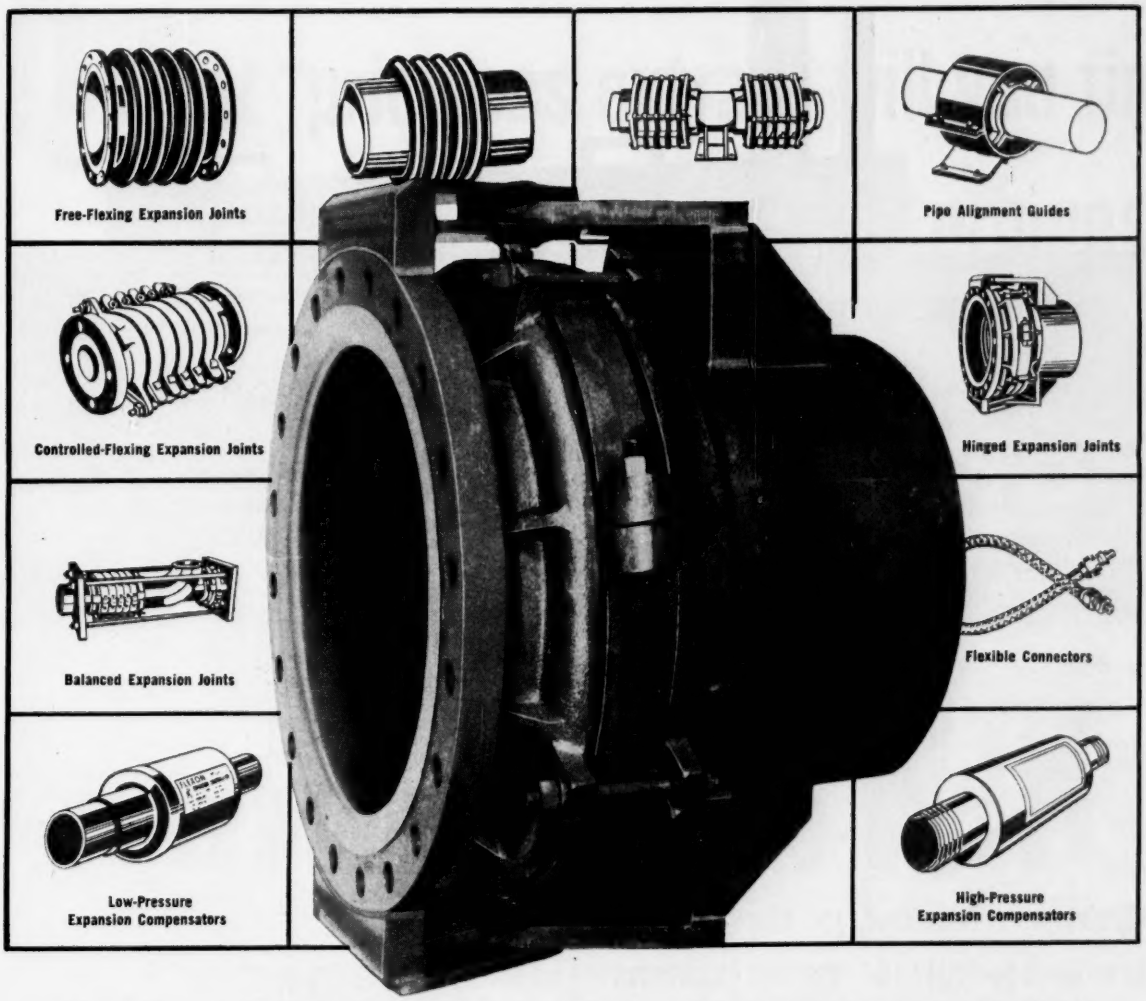
(Member National Insulation Manufacturers Ass'n)

- Saves time, work, money! One quick application provides smooth, light reflectant surface on hot or cold equipment!
- Clean, easy to handle! Just trowel it on—even on irregular areas where application of other insulations is often impractical.
- Highly efficient! Effective insulation at temperatures up to 1000 F.
- For outdoor installations! Quick-setting, withstands rain and moisture two hours after application. Prevents rust!
- For indoor installations! Requires no wire mesh or finishing treatment!



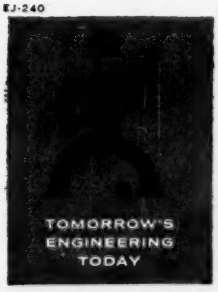
THE COMPLETE LINE TO TAKE CARE OF ANY KIND OF PIPE MOTION

For hinged or any other type of standard or special expansion joints – your best bet is FLEXONICS. Here's where you'll find the equipment, the experience, the skill to take care of any kind of pipe motion problem. Here's where you benefit from more research . . . more metallurgical care . . . more service . . . and now standard stock sizes for quick delivery from five FLEXONICS warehouses. They all add up to expansion joints that you can *install and forget* – plus expansion compensators, flexible connectors, the all-new FLEXONICS pipe alignment guides and other piping accessories.

Today—write for your copy of the Flexonics Expansion Joint Design Guide . . . 28 pages of valuable information.

Member Expansion Joint Manufacturers Association

EJ-240



Flexonics

EXPANSION JOINTS

FLEXONICS CORPORATION • 1317 SOUTH THIRD AVENUE • MAYWOOD, ILLINOIS

Divisions

INDUSTRIAL HOSE • EXPANSION JOINT • BELLOWS • AERONAUTICAL • AUTOMOTIVE

Flexonics Research Laboratories, Elgin, Illinois

In Canada: Flexonics Corporation of Canada, Limited, Brampton, Ontario

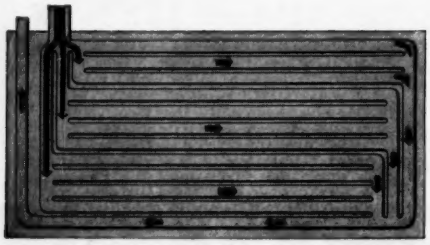
NEW MULTI-ZONE PLATECOIL®

*PATENTS APPLIED FOR

Cuts start-up time, keeps tank temperatures constant

New FLOW PATTERN for more even distribution

Multiple headers and multiple returns provide for FREE-FLO action — with practically instantaneous distribution of steam to all levels of the plate. Condensate "trapping" is held to a minimum. This gives the new MULTI-ZONE PLATECOIL a reserve capacity to deliver under overload conditions during "start-up." It also produces extremely fast recovery of tank temperature with minimum variation.



Operating pressures up to 250 psi

Higher pressure containment is achieved through the use of DURAWELD bonding of the plates and mill-controlled TRANSTEEL in standard MULTI-ZONE PLATECOIL units. This makes it possible to apply the time-proven advantages of PLATECOIL to many types of heating where 250 pound steam is required. Destruction tests have demonstrated a safety factor of more than 5 to 1.

Save on Installation and Maintenance

PLATECOIL costs are low compared to the cost of engineering, fabricating, installing and maintaining pipe coils. PLATECOIL units are lightweight for easy handling. They give more heat transfer per unit of surface. Compact PLATECOIL saves valuable tank space. Deposits do not build as readily on streamlined surfaces as they do on pipe coils. PLATECOIL is also relatively simple and economical to clean. With PLATECOIL, there need be no threaded joints below the liquid level to corrode or leak.

CUT COSTS ON ALL TYPES OF TANK AND PROCESS HEATING AND COOLING APPLICATIONS WITH MULTI-ZONE PLATECOIL.

Write for NEW PLATECOIL BULLETIN P61 FOR COMPLETE SPECIFICATIONS AND DATA.

Tranter Manufacturing Inc.

LANSING 9, MICHIGAN

PLATECOIL® DIVISION

QUESTION: What "priceless extras" will you find in Worthington high speed turbines?

for answer, turn page ——→

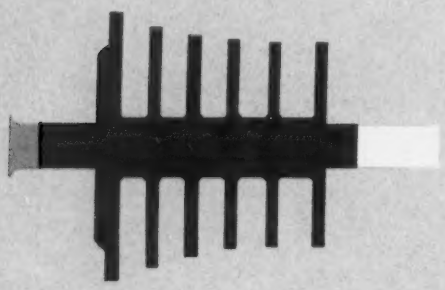
4920 hp, 7000 rpm Worthington turbine drives a centrifugal compressor at Sinclair Refining Co.'s East Chicago, Ind., plant.

ANSWER:

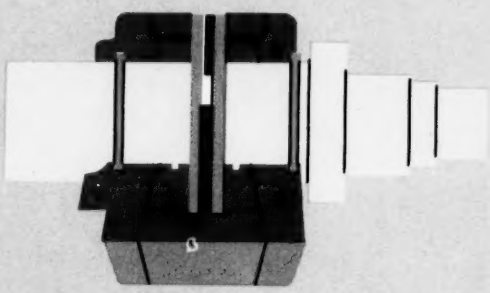
Six quality features . . . key to reliability

Reliability is the ultimate goal of every step that Worthington takes in the design and manufacture of compressor-drive turbines. Worthington reliability is confirmed by 32 years of experience in this specialized field and over 1,257,643 installed horsepower driving all major makes of compressors. When planning your next centrifugal compressor installation, *regardless of compressor manufacture*, be sure to specify a *Worthington* turbine to assure top reliability with flexible, fast and specialized customer services. Worthington Corporation, Wellsville, New York. 48-5

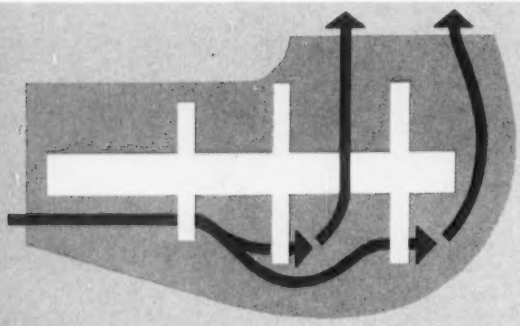
WORTHINGTON



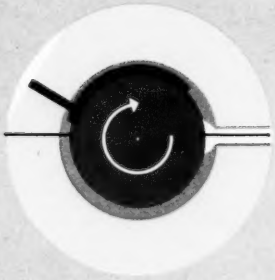
SOLID ROTORS—wheels forged integral with the shaft—provide a more rugged, conservative design.



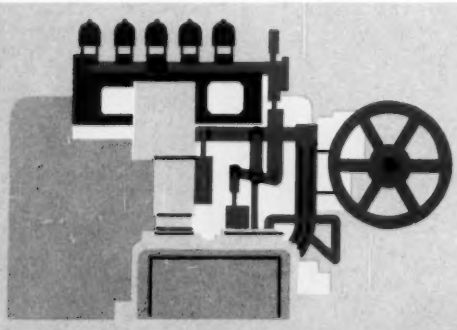
KINGSBURY-TYPE THRUST BEARINGS withstand heavy thrust loads. Shoes pivot, forming a wedge-shaped oil film between thrust collar and bearing surface.



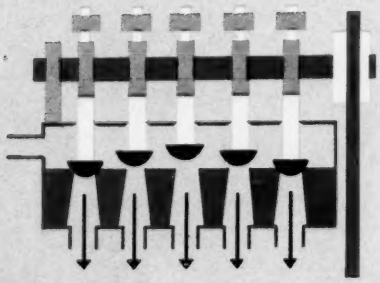
DOUBLE-FLOW EXHAUST—the last stage is divided into two wheels—reduces blade length, increasing efficiency.



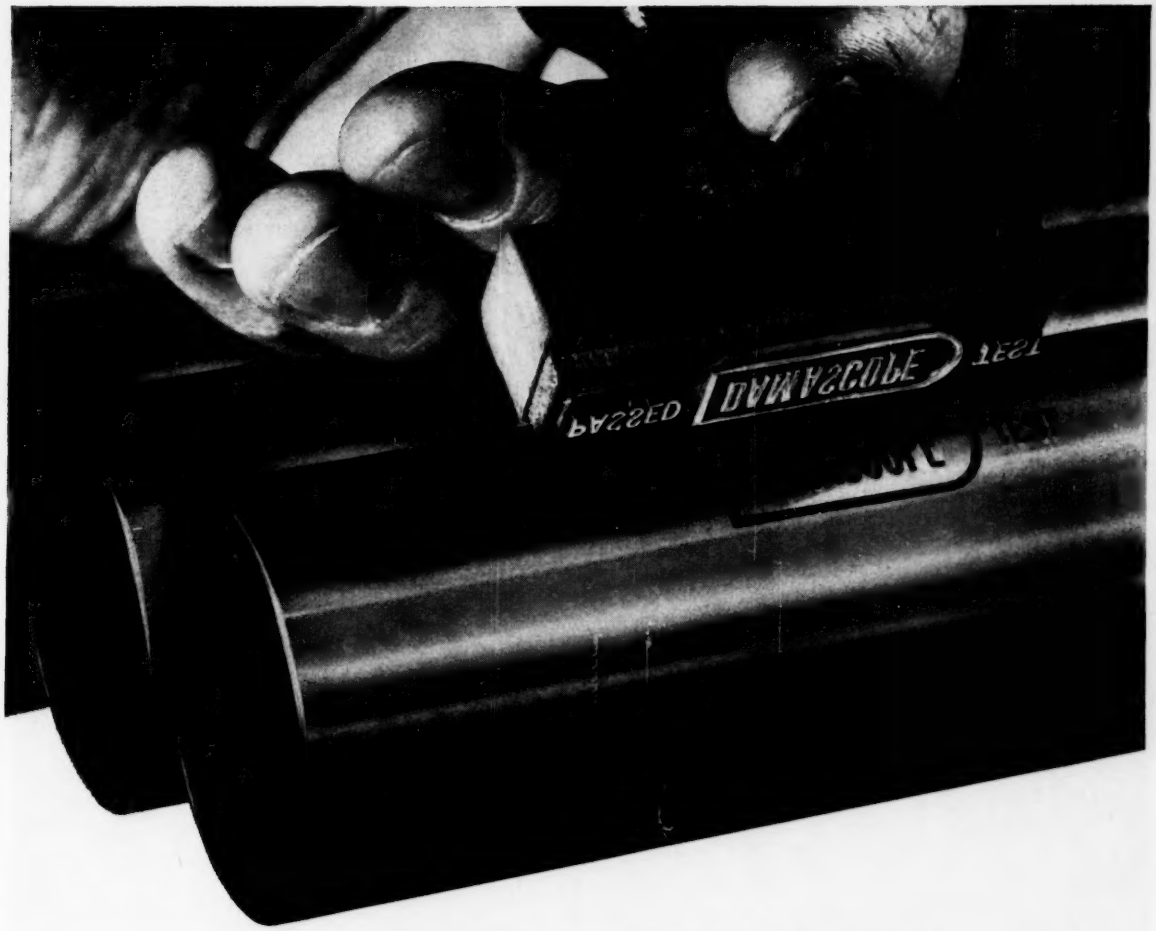
ANTI-OIL-WHIP BEARINGS keep vibration to a minimum. An oil dam in upper half of bearing builds up a pressure pad, keeping rotor firmly in place.



SENSITIVE SPEED GOVERNING SYSTEM provides close control over a wide speed range. (Governor takes air impulses from an outside controller to vary speeds.)



CAM-OPERATED AUTOMATIC NOZZLE CONTROL. Each valve, with separate cam, controls a group of nozzles for maximum economy at all loads.



AT LAST A CONCLUSIVE NON-DESTRUCTIVE TEST OF PRESSURE TUBING QUALITY

FOR COMPLETE INFORMATION ON DAMASCOPE TESTING

Write for bulletin describing operation, range of sensitivity, advantages, and general background on Damascope testing.

MEETS A.S.T.M. SPECIFICATIONS—Damascope is a new and improved method of RADAC eddy current testing. It consistently reveals surface and sub-surface cracks, seams, splits, holes, inclusions and other discontinuities not revealed by any other inspection method. On production run testing, Damascope's range of sensitivity exceeds requirements for pressure tubing outlined in A.S.T.M. Book of Standards, Part I.

EVERY TUBE IS TESTED—All Damascus pressure tubing is now Damascope inspected in addition to other accepted testing procedures. Damascope is an absolute test of quality, revealing the presence, location and size of harmful flaws. The entire periphery of the tube is examined inside and out, through the wall, and for the full tube length. *This is a 100% check*—each tube is inspected and imperfect tubes are automatically rejected.

SUITABLE FOR NUCLEAR WORK—For nuclear or other critical applications, Damascope can be even more closely calibrated to yield a tube of super quality. Damascope is powered by batteries which eliminate the variable effects caused by current surges. It also employs modulation analysis to separate eddy current signals from background interference.

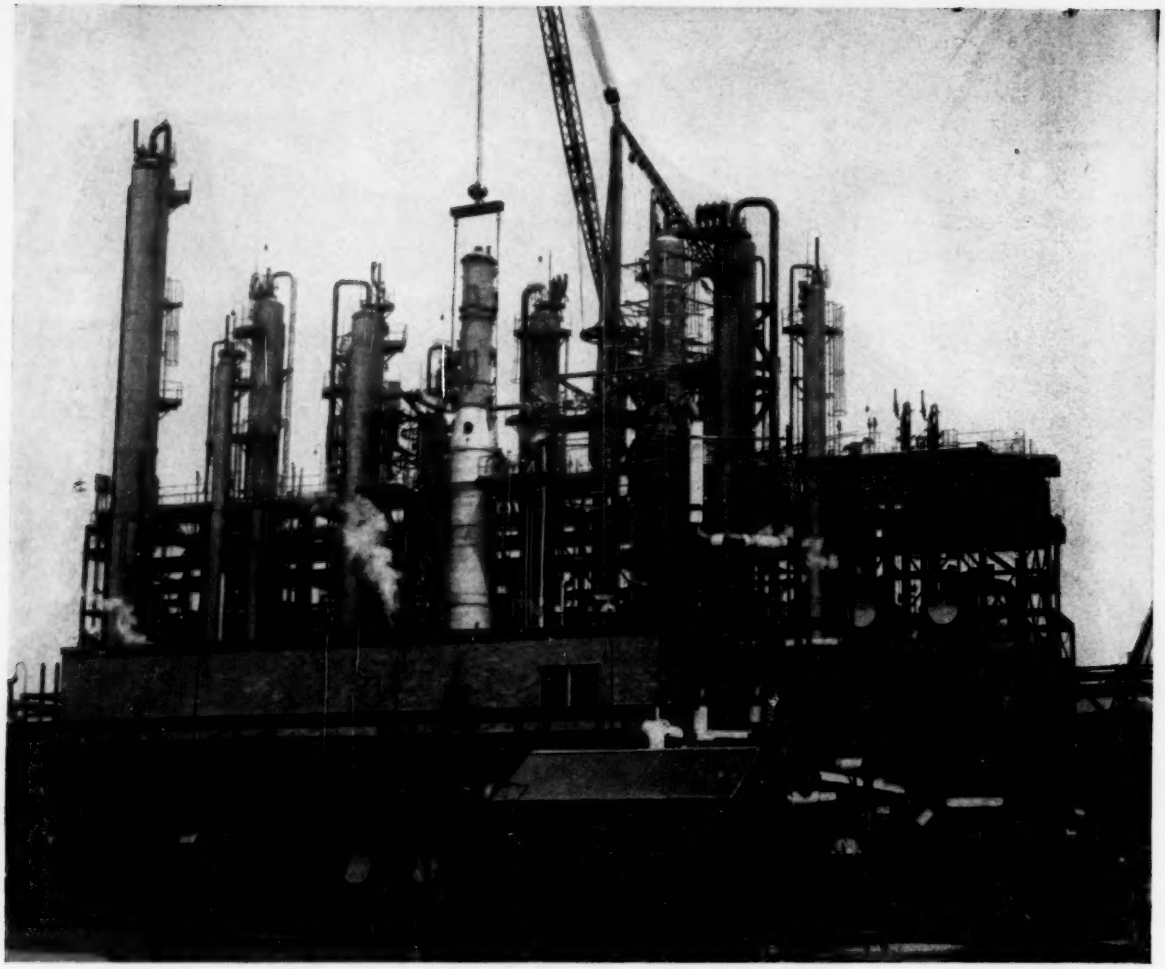
DAMASCUS TUBE COMPANY

STAINLESS STEEL TUBING AND PIPE

GREENVILLE, PENNSYLVANIA

AMERICAN STEEL WAREHOUSE ASS'N

POWER STEAM TUBE INSTITUTE



Erecting the all-welded, two-part chromium-nickel stainless steel recovery tower at Gary chemical works of United States Steel Corporation. Graver Tank & Mfg. Co., Inc. of East Chicago, Indiana, fabricated the 90-foot tower and tested it to pressures of 162 psi and 246 psi.

Stainless steel tower goes up...corrosion comes down... in recovery of aromatic chemicals from coke oven gases

This chromium-nickel stainless steel tower recently took over an important job at the Gary Steel Works Coke & Coal Chemicals Div. of U. S. Steel. The big vessel receives hot absorption oils from other parts of the processing plant . . . puts them through its six-tray light oil section, and 15-tray light oil stripper . . . recovers benzene, toluene, and xylene.

It's a productive but highly corrosive process. So corrosive that it knocked out a carbon steel tower in relatively short time. That's why for its replacement the Gary Works decided on Type 304 ELC chromium-nickel stainless steel. This nickel-containing stainless steel can take the corrosive effects of these gases and chemicals . . . it assures *long* service life.

For your corrosion problems, it will pay you to consider nickel-containing stainless steels. They are highly resistant to a wide range of organic and inorganic chemicals.

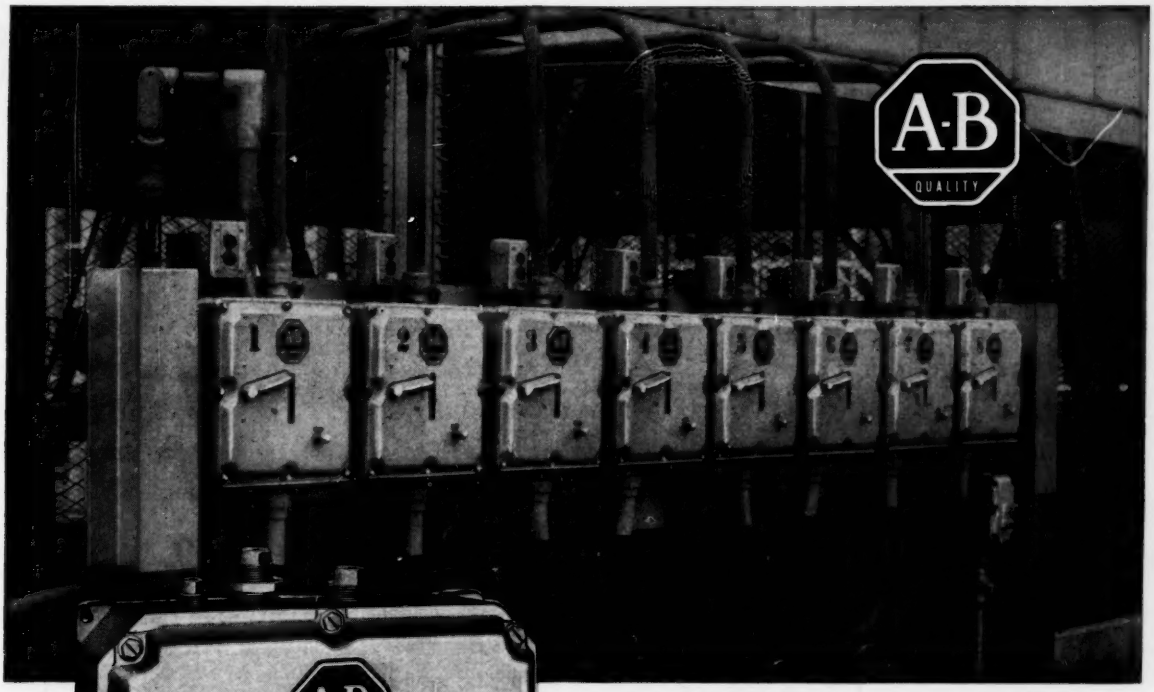
* * *

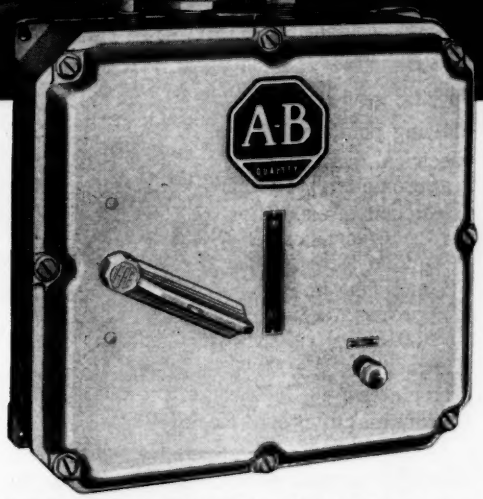
A 34-page booklet, "Corrosion Resisting Properties of the Austenitic Stainless Steels," is available to you upon request. If you'd like a copy, simply write:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL ALLOYS PERFORM BETTER LONGER





Bulletin 713 Combination Starter with circuit breaker in NEMA Type 9 enclosure for hazardous dust locations.

NEMA 7
For Hazardous Gas Locations

NEMA 4
Watertight Weatherproof

NEMA 8
For Corrosive Hazardous Gas

NEMA 11
Corrosion-proof

Round-the-clock safety . . . and reliability . . . without costly maintenance

When hazardous locations require starters in explosion-proof enclosures, it usually means costly maintenance. But *not* when you use A-B starters, because you eliminate the expense of removing and replacing bolted covers for "regular" inspection! In all A-B starters there is only ONE moving part. This is your assurance of *millions* of trouble free operations. There are no bearings to stick . . . no flexible jumpers to break. And the double break, silver alloy contacts never need servicing —they remain in perfect operating condition until completely worn away. The permanently accurate thermal overload relays are another "plus" feature. Insist on Allen-Bradley controls . . . and save on maintenance throughout the years.

ALLEN-BRADLEY
Quality Motor Control

Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

KANIGEN®

The proved nickel alloy chemical plating—available only from General American and its licensees

KANIGEN is a chemically and metallurgically unique process for applying a hard, corrosion and abrasion resistant surface to most metals. KANIGEN is being used successfully for coating almost everything of any size—from the inside of a tank car to a tiny surgical needle—providing extreme uniformity of coating thickness even on complex shapes. Rack, jig or barrel plating may be used with KANIGEN.

You can rely on General American's integrity and experience and profit from its extensive research and development facilities. KANIGEN, of course, is patented to protect you from imitations.

KANIGEN is a trademark which identifies chemical nickel coating by General American Transportation Corporation and its licensees, the product resulting therefrom and compositions produced by them for use in chemical nickel coating.

KANIGEN is available from General American at East Chicago, Indiana; Sharon, Pennsylvania, and Compton, California, and from licensees in many cities. For further information, call or write.

PHYSICAL PROPERTIES

Specific gravity 7.9
Melting point ..... 1635 °F
Electrical resistivity
approximately 60 micro-ohms/cm/cm²
Coefficient of expansion
13 x 10^{-6} cm/cm per °C or
7.22 x 10^{-6} in/in per °F
Thermal conductivity
approximately 0.0105 to
0.0135 cal/cm sec °C (calculated)
Hardness
as plated—49 Rockwell C
heat treatable to 70 Rockwell C

World's largest production facilities for chemical nickel alloy plating on
Iron
Copper
Aluminum
Titanium
Beryllium
and their alloys

Pilot plant facilities are available for nickel alloy chemical plating on magnesium, uranium and non-metallics including thermosetting plastics, glass, ceramics.

Kanigen Division

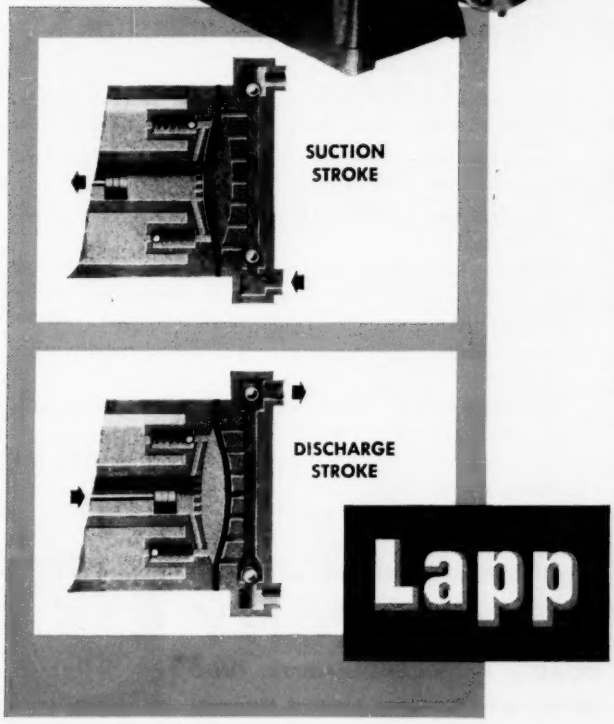
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street • Chicago 3, Illinois

KANIGEN GENERAL AMERICAN TRADE MARK

How Much Does Stuffing Box Leakage Cost You?

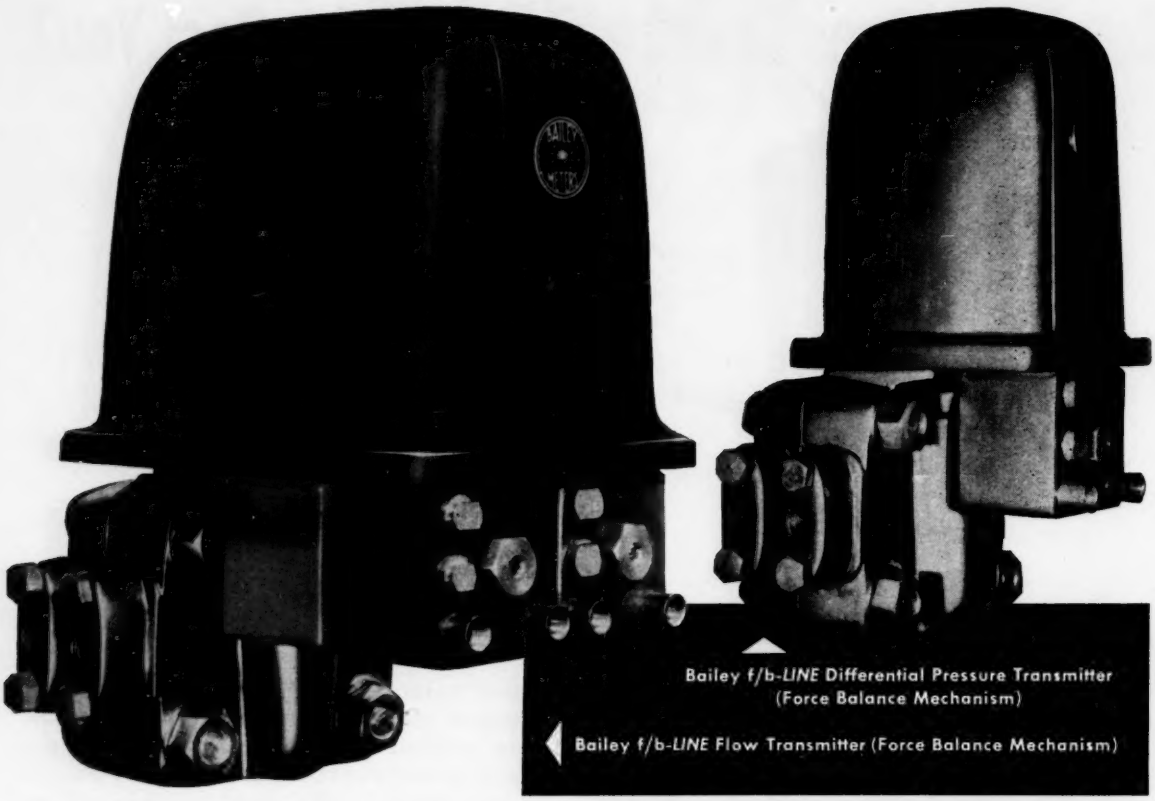
Lapp PULSAFEEDER
CONTROLLED-VOLUME CHEMICAL PUMP



Many industrial plants, using small capacity chemical pumps, are confronted with the common problem of stuffing box leakage. Although much is done to accommodate for this pump deficiency, the day-to-day cost of various liquids lost through leakage is usually overlooked.

Normal stuffing box pump leakage is one to three drops per stroke. Thinking in terms of cost per gallon, consider a simplex stuffing box type pump handling phosphoric acid. An average two drops per stroke, 50 strokes per minute leakage represents a yearly operating loss of $1,240. Such costly stuffing box leakage is typical. Yet it can be eliminated instantly by installing a Lapp Pulsafeeder diaphragm pump. The Pulsafeeder has no stuffing box . . . leakage and contamination of liquid being pumped is prevented by a hydraulically balanced diaphragm isolating the liquid from the pump's drive mechanism. Pumping speed is constant; variable flow results from variation in piston-stroke length, controlled manually by hand-wheel, or in Auto-Pneumatic models, by instrument air pressure responding to any instrument-measurable processing variable. Pulsafeeder capacities range from 585 ML per hour up to 24 gpm maximum flow and pressures from minus atmospheric to 6800 psig.

WRITE FOR BULLETIN 440 containing typical applications, flow charts, description and specification of models of various capacities and constructions, also special leakage chart. Lapp Insulator Co., Inc., Process Equipment Division, 3611 Poplar St., Le Roy, New York.



Bailey f/b-*LINE* Differential Pressure Transmitter (Force Balance Mechanism)

Bailey f/b-*LINE* Flow Transmitter (Force Balance Mechanism)

Two new Bailey *f/b-LINE* Transmitters

permit new accuracy in measuring flow and differential pressure

Pneumatically transmits rate of flow—or differential pressure—measurements to indicating, recording, and/or controlling equipment at remote stations. Transmitters consist of a diaphragm measuring mechanism and a force balance pneumatic transmitting unit.

APPLICATION

For steam, water, air, gases and other fluids producing differentials across primary elements from 0-2 in. H_2O to 0-2000 in. H_2O at maximum service pressure of 50, 1500, and 5000 psig.

FEATURES

Transmits a Signal Directly Proportional to Rate of Flow. Uses receiver with uniformly-graduated chart or scale. Eliminates need for external square-root extractors or characterizers.

10 to 1 Turndown. Differential range of each diaphragm measuring element may be changed by factor of 10 to 1; e.g., 0-20 in. H_2O diaphragm may also measure 0-2 in. H_2O.

Screwdriver Adjustments. Range and zero adjustments readily accessible. Range may be changed with screwdriver adjustment.

Overpressure Protection. Protects against full service pressure applied to either side of diaphragm.

Fast Response. No viscous dampers needed, so speed of response is very fast.

Corrosion Resistant. For maximum differentials between 20 and 2000" H_2O, all parts in contact with process fluid may be stainless steel. No sealing fluids or sealing diaphragm required.

Good Stability. Reset type boosters give good stability with high gain.

Versatile Mounting. May be mounted on process piping, wall, or separate mounting pipe using same bracket.

For additional information, call your local Bailey District Office, or write direct.

CP3-1

Chemical and petroleum division

BAILEY METER COMPANY

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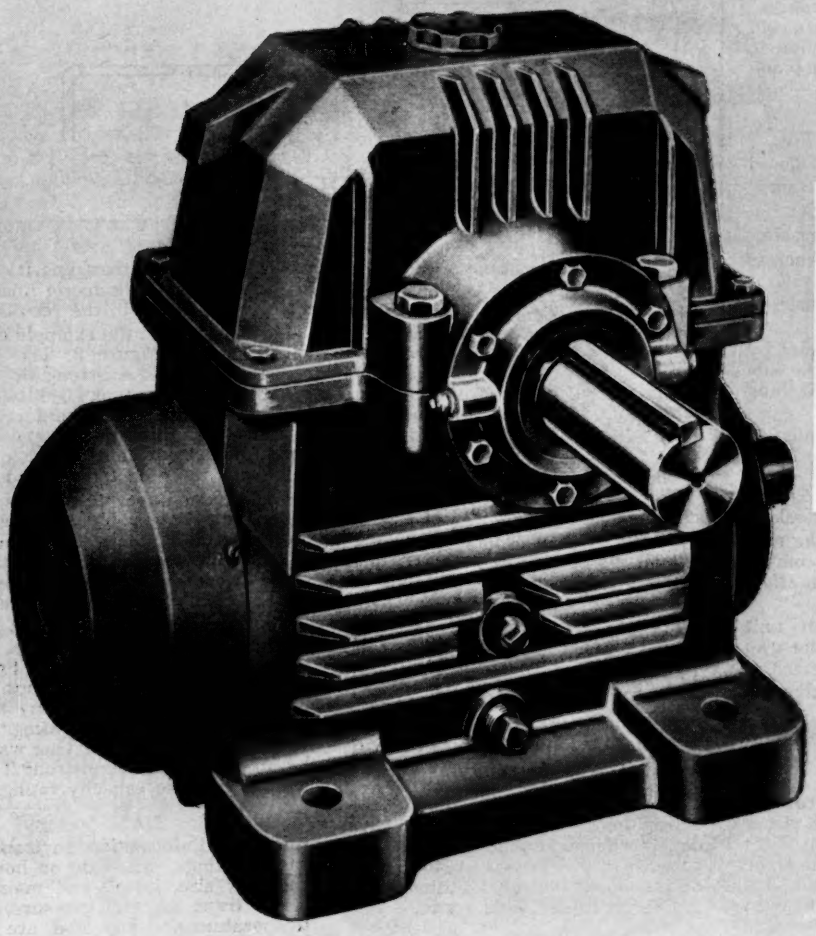
in Canada—Bailey Meter Company Limited, Montreal

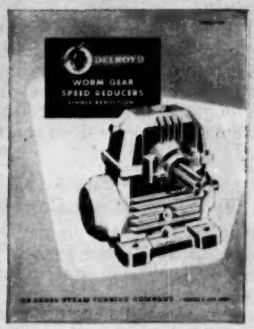
DELROYD
SPEED REDUCERS

De Laval Announces All New Line of Single Reduction Speed Reducers



DELROYD
TYPE B
fan cooled
5" through 12" center distance
★

Send for this new 32-page Bulletin 3805 today.



New Delroyd single reduction speed reducers are available in a wide range of sizes and horsepower ratings. These worm gear units include centrifugally cast gears and fan cooling, and carry *the new AGMA ratings.*

DE LAVAL *Steam Turbine Company*
803 NOTTINGHAM WAY, TRENTON 2, N. J.

DL 478

Some Straight Talk On Steam Trap Capacity

. . . or pulling away the curtain of confusion that surrounds steam trap capacity ratings.

Unfortunately, for the steam trap buyer, the subject of steam trap capacity has become cloudy and confused by a landslide of claims, counterclaims and inconsistent "standards" for measurement. So let's take a cold hard look at this subject so vital to the efficient operation of your plant.

What Determines Steam Trap Capacity?

There are three factors that determine the capacity of a steam trap:

1. The area of the orifice.
2. The density of the condensate.
3. The pressure differential across the trap.

Let's take a closer look at each of these:

Area of orifice is usually specified by the trap manufacturer or can be calculated from the diameter. Nothing complicated here.

Density of condensate depends on temperature. A cubic foot of cold water weighs 62.4 lbs. At 250° F. or 15 psi, it weighs less than 59 lbs. This is important. Don't overlook it.

Pressure differential across the trap is most significant. And it is complicated by the many factors that affect it, such as:

1. Pressure drop between unit drained and the trap when the trap valve is open.

2. Distance the trap valve is moved from the valve seat.

3. Back pressure on the trap with orifice closed; i.e., return header pressure.

4. Increase in back pressure produced by condensate and flash steam flowing in the discharge line. This in turn is affected by the diameter and length of the discharge line, plus friction caused by valves and fittings.

Orifice Capacity Vs. Steam Trap Capacity

Figure 1 shows a ½" diameter sharp-edged orifice at the end of a pipe filled with cold water at 15 lbs. pressure. The capacity of this orifice, using a .61 coefficient of flow would be 8,800 lbs. per hr. Now, would this ½" orifice if used in a ¾" steam trap installed as shown in Figure 2 provide the trap with a continuous discharge capacity of 8,800 lbs. of hot condensate per hour? The answer is "no". And here are some of the reasons why:

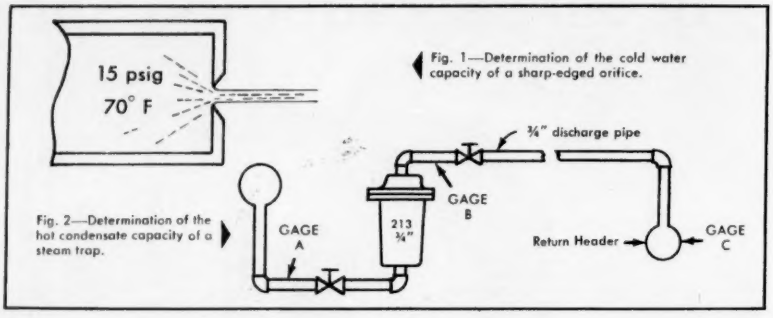


Fig. 1—Determination of the cold water capacity of a sharp-edged orifice.

Fig. 2—Determination of the hot condensate capacity of a steam trap.

Density of condensate. As pointed out above, cold water weighs 62.4 lbs. per cu. ft. At 15 lbs. pressure and 250° F. water weighs less than 59 lbs. per cu. ft. This difference in density alone reduces the lbs. per hour capacity of the orifice by over 5%.

Pressure differential across the trap. With the trap valve closed we have a static pressure differential of 15 psi. The trap valve must be able to open against this pressure. However, this is not the pressure differential that will determine the capacity of the trap valve.

The ¾" discharge line will be full of a mixture of flash steam and condensate. To keep this mixture flowing from the trap outlet to the return line requires a pressure differential. In actual capacity tests run as shown in Figure 2 Gage B at the trap outlet registered 11 lbs. back pressure. Thus the true pressure differential across the trap was about 4 lbs. Under these conditions the measured capacity of the trap was 4,340 lbs/hr. or just about half of the capacity of the ½" orifice for cold water.

How Armstrong Determines Capacity Ratings

Armstrong trap capacity ratings are based on hundreds of tests under actual operating conditions. In these tests, the condensate used was at the steam temperature corresponding to the test pressure. Thus, the capacities determined take into account the pressure drop that occurs when the trap orifice opens and the choking effect and back pressure of the flash steam. Actual installation hookups were used so that pipe friction in both inlet and discharge lines as well was reflected in the results.

Let's go back to the example cited above and in Figure 2. The trap referred to is an Armstrong No. 213. While it did test out at 4,340 lbs. per hour for a static pressure differential of 15 psi, it is rated in the catalog at only 3900 lbs. per hour for this pressure—just to be on the safe side.

For the trap buyer, this means that Armstrong Steam Trap capacities are based on handling condensate at steam temperature for the stated static steam pressure differential under actual working conditions.

Capacity ratings which don't take into account all of the variables will be misleading and may lead to the selection of undersized traps. So whenever you specify or buy traps be sure that the capacity ratings you work from are realistic. One way to be sure is to select Armstrong Traps with *guaranteed* capacity ratings.

* * *

Additional information on trap capacity ratings, plus data on how to correctly size, install and maintain steam traps for any pressure, any temperature and any load, are presented in the 48-page Armstrong Steam Trap Book. Ask your local Armstrong Representative for a copy or write:

Armstrong Machine Works
8581 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

Because only Jenkins
gives you this 18 Point Protection
against valve repairs

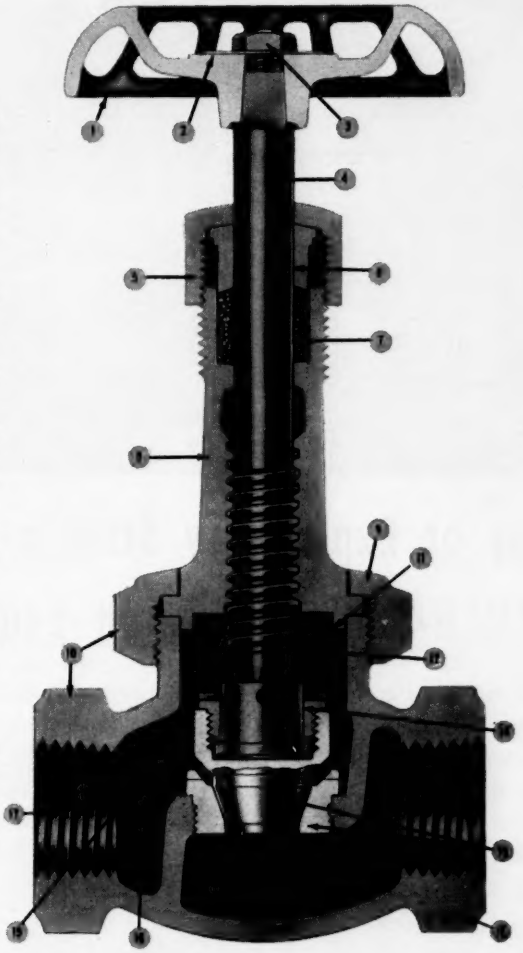
Specify JENKINS for PLUG TYPE Bronze Valves, too

THROTTLED STEAM with its destructive erosive effect on a valve seat . . . hard, seat-cutting substances like rust tubercles, boiler scale, pipe chips. Such valve destroyers have little or no effect on a Jenkins Bronze Plug Type Valve. Jenkins 500 Brinnell Armor Seat defeats them.

There's much more to the durability of these valves than the seat. Jenkins gives you 17 *other* superior features that contribute to long-life and completely satisfying service. All are important to any valve user who wants maximum economy, and only Jenkins gives you all of them. Send for literature which gives full details about them.

Still more protection against valve repairs comes from superiorities which cannot be seen in any picture of a valve: The quality in the castings . . . the precision machining . . . the rigid inspection and testing which every Jenkins Diamond-marked valve undergoes.

You have many sound reasons for specifying Jenkins when the service calls for PLUG TYPE Bronze Valves. And you pay no premium for them. Write us or ask your Jenkins distributor for information folder.



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5. LARGE PACKING NUT
6. SELF-ALIGNING PACKING GLAND
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8. HEAVY BONNET
9. HUSKY UNION BONNET RING
10. UNIQUE WRENCH LUGS
11. CORRECT ALIGNMENT OF PARTS
12. BACK SEATING PROTECTS THREADS
13. PLUG AND SEAT RING OF CHROMIUM STAINLESS STEEL
14. LOCKNUT
15. FULL DIAPHRAGM-SHELL CLEARANCE
16. LIBERAL DIAPHRAGM WALL CLEARANCE
17. FULL LENGTH PIPE THREADS
18. EXTRA HEAVY BRONZE BODY

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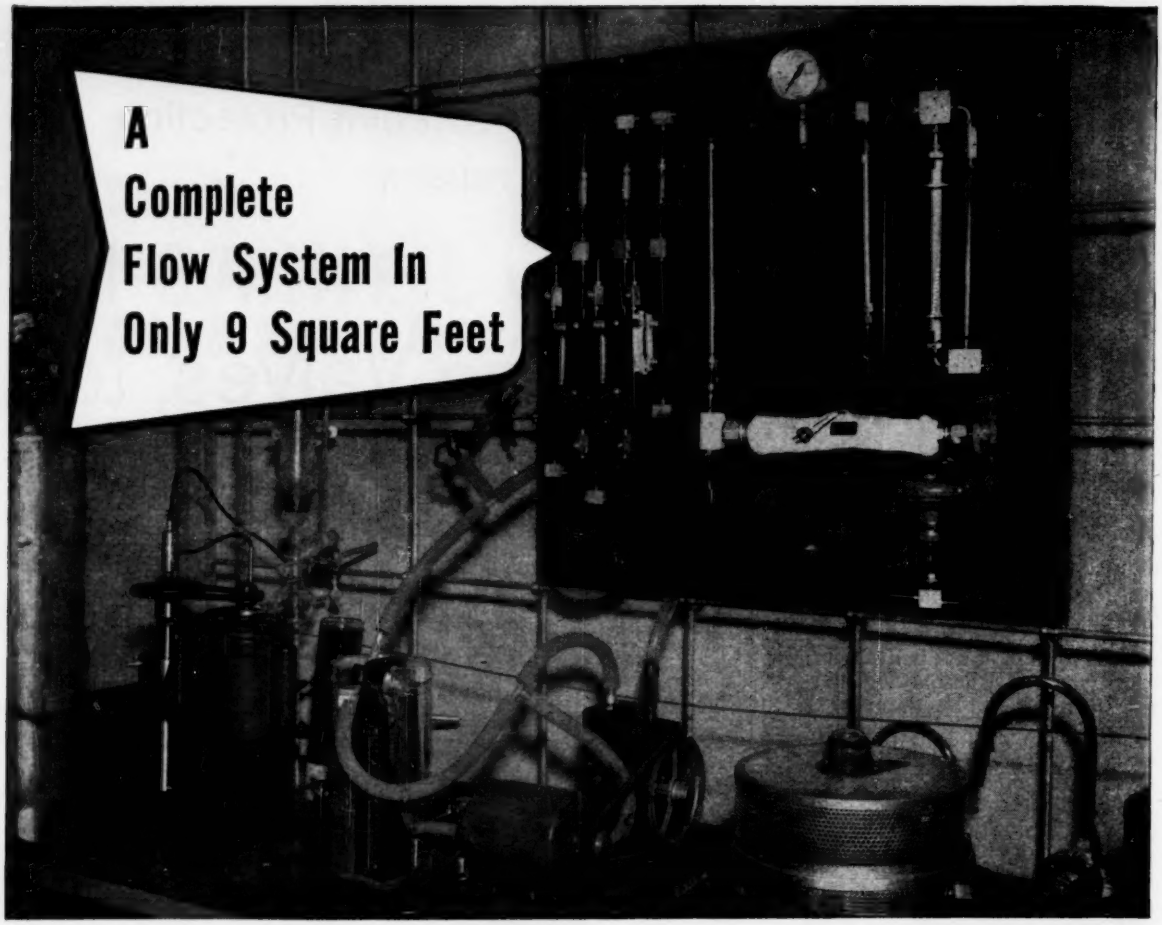

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This AE BENCH-SCALE equipment enables you to carry out in your own laboratory a wide variety of preliminary investigations such as feasibility studies before proceeding with scaled-up operations . . . research studies where only minute or limited quantities of expensive materials are available . . . batch, semi-batch or continuous reactions . . . and many other exploratory studies.

Best of all are the savings in space, time and money you'll realize with this equipment. You *save space* because every unit is specifically designed for bench-scale work. You *save time* in setting up or altering the system because of simplicity of design and resultant ease of assembly. And you *save money* because the equipment is easily and quickly assembled by your own laboratory personnel—neither skilled craftsmen nor special tools are required.

Detailed information on AE BENCH-SCALE Research Equipment is given in Bulletin 658. Send for your copy today.

AUTOCLAVE ENGINEERS, INC

2932 WEST 22nd STREET, ERIE, PENNSYLVANIA

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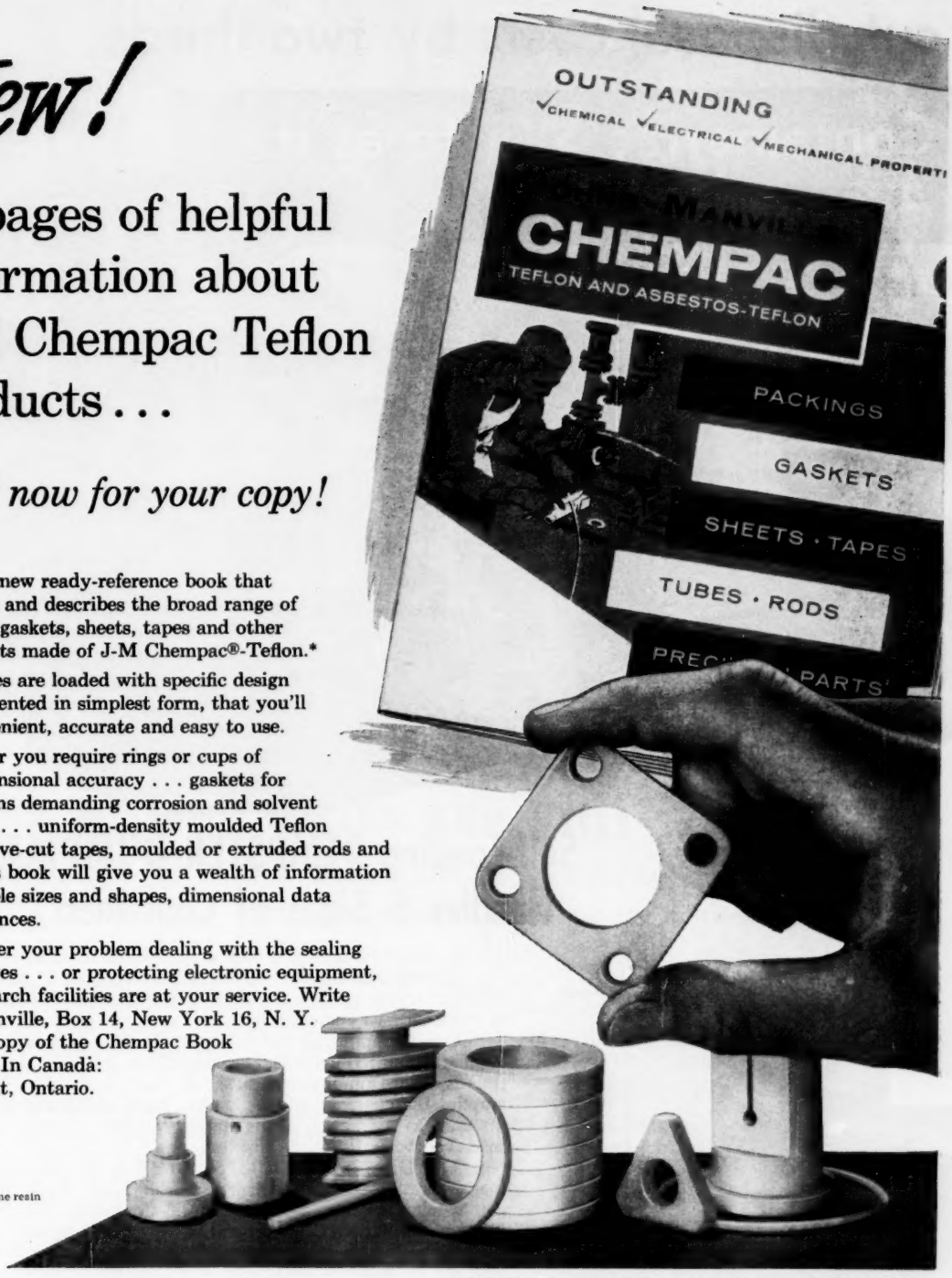

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Its pages are loaded with specific design data, presented in simplest form, that you'll find convenient, accurate and easy to use.

Whether you require rings or cups of high dimensional accuracy . . . gaskets for applications demanding corrosion and solvent resistance . . . uniform-density moulded Teflon sheets, skive-cut tapes, moulded or extruded rods and tubes, this book will give you a wealth of information on available sizes and shapes, dimensional data and tolerances.

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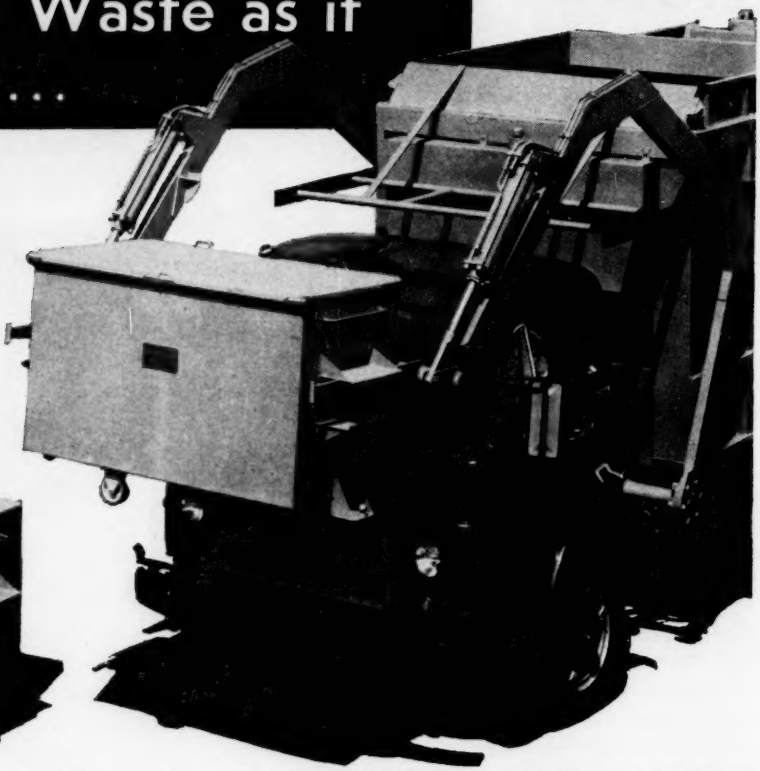
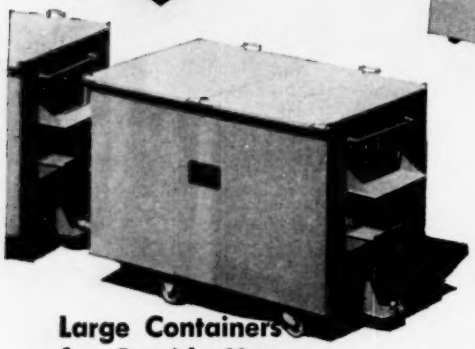
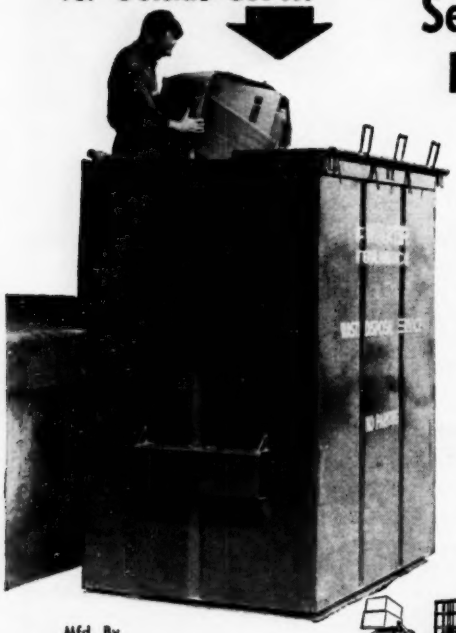


Small Tracking Containers for Indoor Use...



Large Containers for Outside Use...



Mfd. By DEMPSTER BROTHERS Inc.

Self-Loading DEMPSTER-DUMPMASTER Handles 6 Sizes of Containers...

If you're using boxes, bins, cans or carts to handle or store big-volume waste and refuse, you can reduce costs by more than two-thirds with the new DEMPSTER-DUMPMASTER System of waste storage and collection.

One Dumpmaster serves any number of detachable metal containers placed at waste accumulation points. Making its rounds, the Dumpmaster picks up each container, in turn, empties the contents into its packer body and compresses the material to a fraction of its former volume assuring big pay loads on every trip to the disposal area.

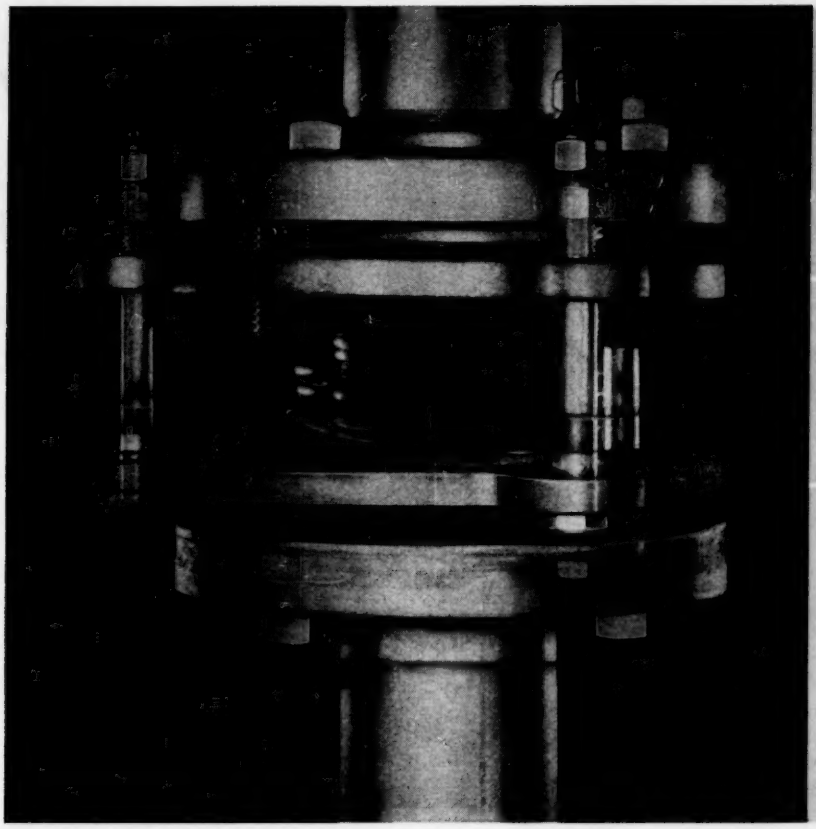
The DEMPSTER-DUMPMASTER is economical! One man operation. It's safe! Clearance lifting arms never pass the cab windows, can't injure operator. Containers can be used indoors or outdoors, on ground, below grade or on a dock.

This system is also available on a monthly fee basis through a nearby DEMPSTER-DUMPMASTER equipped private hauler, (name furnished on request).

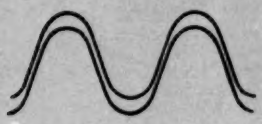
WRITE TODAY FOR FREE BROCHURE

DEMPSTER DUMPSTER® SYSTEMS

Dept. CE-9 DEMPSTER BROTHERS, Knoxville 17, Tennessee

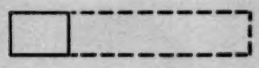


MOLDED DESIGN



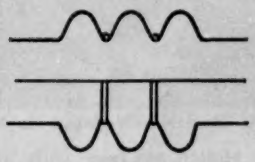
rounded interior convolutions, extra thickness at stress points

HIGH TENSILE STRENGTH



Teflon at its best, Fluoroflex-T provides at least 300% elongation

METAL REINFORCING RINGS



permit greater travel from shorter units, prevent distortion from surges

2 MILLION CYCLES AND STILL FLEXING!

...proving that this Teflon expansion joint—molded of Fluoroflex-T —outlasts most other materials and constructions

Chemical manufacturer: Tried Fluoroflex®-T joint, found it *still* flexing after *2 million cycles;* previously had averaged 100,000 cycles from machined Teflon® flex joint in pumping application.

Major industrial product company: Displaced one end of a special Fluoroflex-T bellows ¾-inch from its axis, rotated it around axis at 1,000 rpm. After *20 million cycles,* with still no sign of deterioration, test discontinued.

Petrochemical processor: Installed Fluoroflex-T joints to replace joints machined from Teflon. The Fluoroflex-T joints are still in service after nearly a year.

Fluoroflex-T flex and expansion joints perform so much better for three reasons: (1) *The material:* a patented compound of Teflon that combines high density with low crystallinity for optimum strength and flexibility. (2) *The process:* a unique technique for molding uniform convolutions with restraining rings. This gives undamaged grain structure, rounded interior convolutions and increased strength. (3) *The experience:* Resistoflex has been working with fluorocarbon resins since their inception. For fabricating with Teflon, such experience is *vital.* That's why Fluoroflex-T is Teflon at its best.

So, for corrosion-proof flex and expansion joints that give unsurpassed working life, specify Fluoroflex-T. Write for Bulletin B-1A. Dept. 303, RESISTOFLEX CORPORATION, Roseland, N. J. Other Plants: Burbank, Calif.; Dallas, Tex.

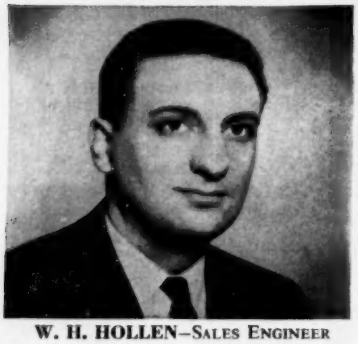
®Fluoroflex is a Resistoflex trademark, reg., U. S. pat. off.
®Teflon is DuPont's trademark for TFE fluorocarbon resins.

Complete systems for corrosive service

RESISTOFLEX

News from
National Carbon Company
Division of Union Carbide Corporation • 30 East 42nd Street, New York 17, N.Y.
Sales Offices: Atlanta, Chicago, Dallas, Houston, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco. IN CANADA: Union Carbide Canada Limited, Toronto

National Carbon representatives expand your engineering force



W. H. HOLLEN—SALES ENGINEER

Mr. Hollen has been with National Carbon Company since 1955 when he graduated from Fenn College with a B.S. Degree in Chemical Engineering.

He has worked on the development and design of chemical process equipment, and worked directly with users on the installation of carbon, graphite and "Karbate" impervious graphite equipment. Recently, he has been named field sales engineer covering the mid-continent states. His headquarters are in St. Louis.

NEW CATALOG AVAILABLE ON IMMERSION TYPE HEAT EXCHANGERS

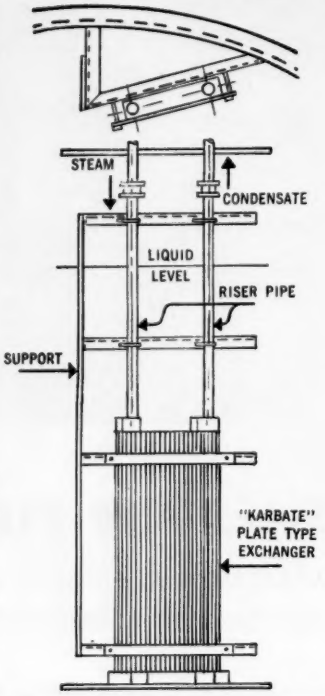
A new 12-page catalog on immersion type heat exchangers and circulating steam jets is available from National Carbon Company. It contains complete information on application, installation and operation of standard plate, bayonet, and coil type exchangers, plus circulation steam jets. Write for CATALOG NUMBER S-6620.

NATIONAL TRADE MARK

"National", "Karbate", "N" and Shield Device and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

UNION CARBIDE

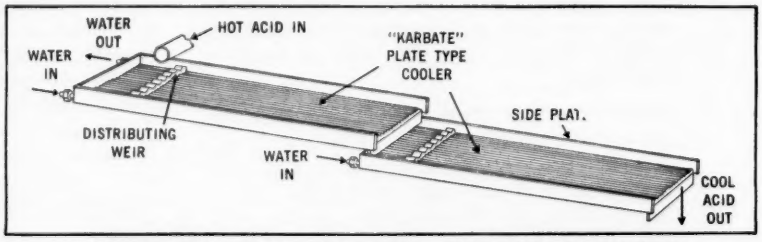
UNIQUE INSTALLATIONS SHOW ADAPTABILITY OF "KARBATE" PLATE EXCHANGERS



"KARBATE" PLATE HEATERS USED IN STARCH MODIFYING PROCESS

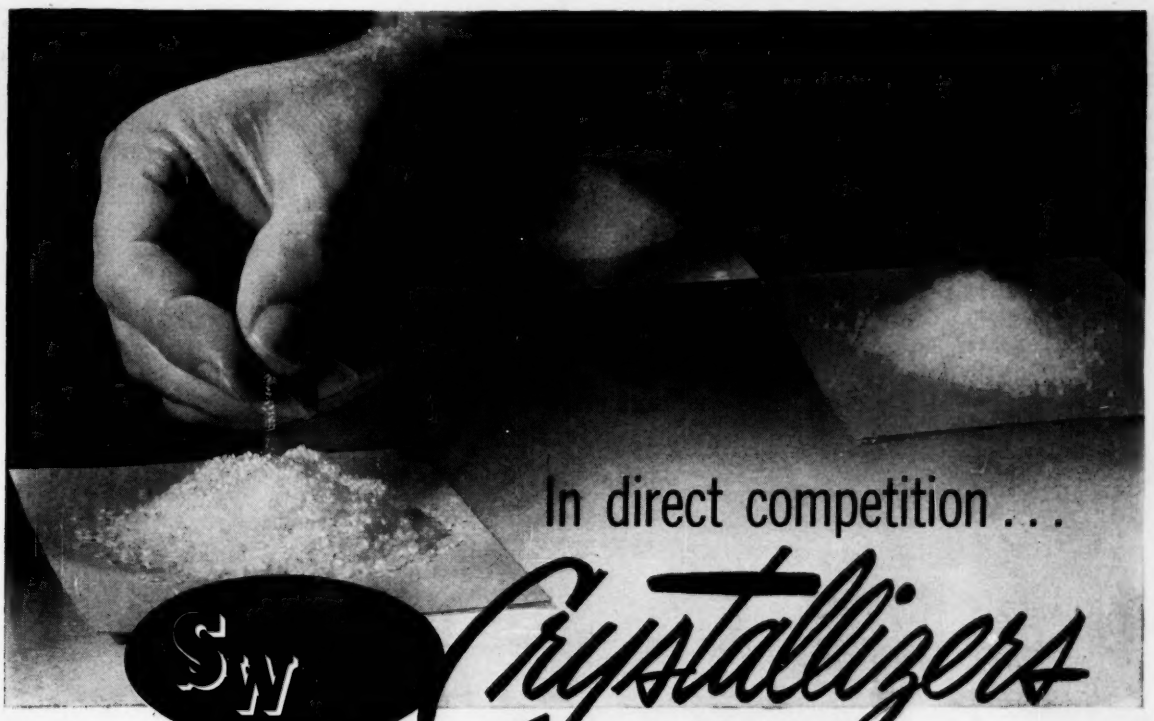
In 1956, nine 94" long "Karbate" impervious graphite plate heaters, style VVFS-2, were installed in a starch modifying tank. The complete corrosion resistance and rugged construction of this type of exchanger were factors for its selection in this application. Steam is used as the heating medium.

On the basis of this installation, four additional starch modifying tanks were equipped with "Karbate" plate type units in 1957.



"KARBATE" PLATE EXCHANGERS USED AS TROUGH COOLER

"Karbate" plate exchangers, style VVUS-2, are used to cool 85 to 106% phosphoric acid produced by the thermal process. The standard plate type exchanger is fitted with "Karbate" impervious graphite side, end and drip plates to form a trough. Troughs are installed at a slight incline permitting the acid to flow down the fins. The number of plates in series and/or parallel depends on the cooling required. Some installations are handling acids having inlet temperatures of 400° to 450°F.



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4. FREE-FLOWING, NON-CAKING PRODUCT
5. HIGH PURITY CHEMICAL
6. ADDED SALES APPEAL

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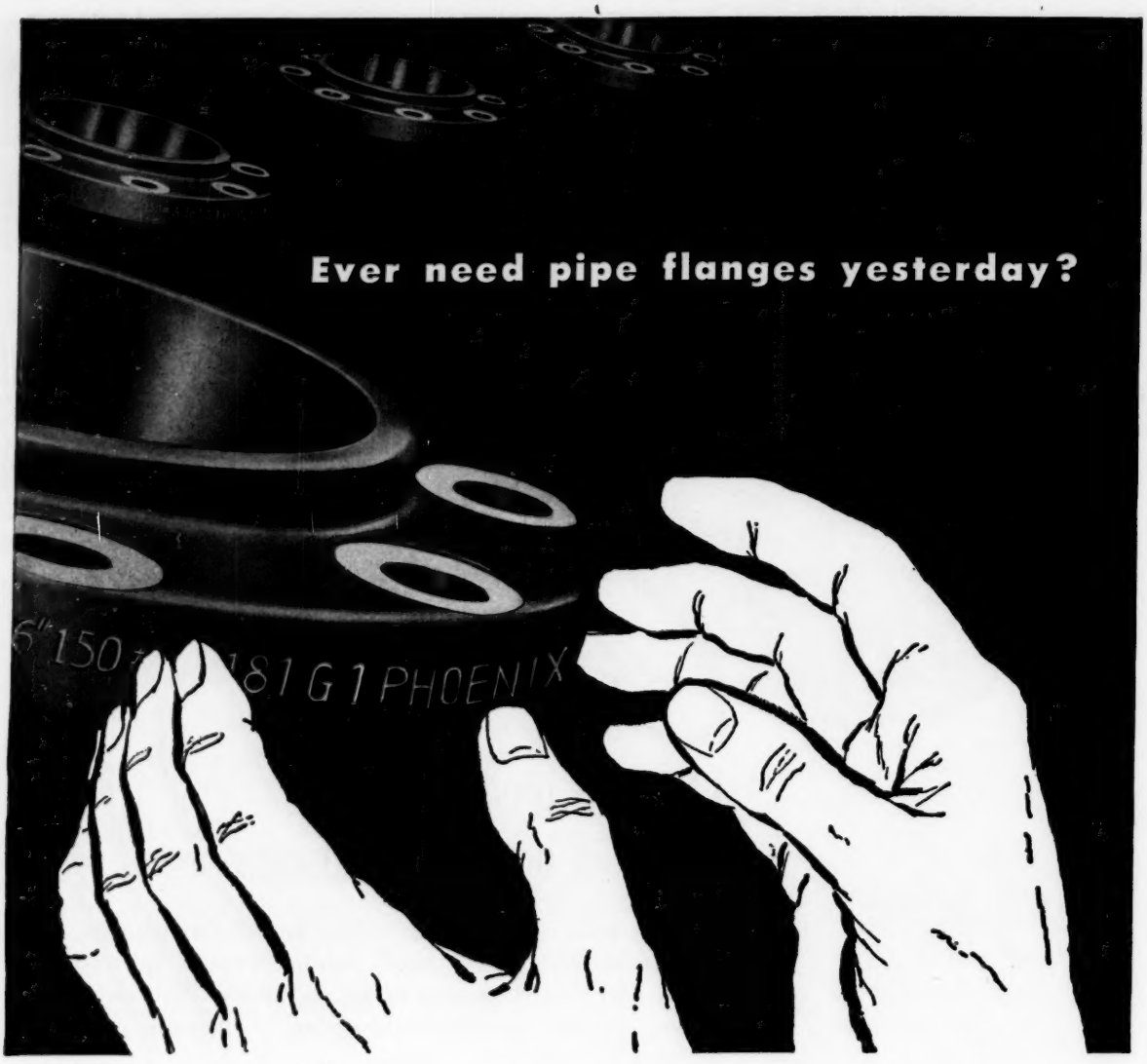

Try your TWX or telephone the next time you need pipe flanges in a hurry. Phoenix will get them into your hands quickly without order processing red tape and delays. All popular types and sizes are available for immediate shipment from Catasauqua, Pa. in the East and from Joliet, Ill. in the Midwest by air, truck, rail or water. You never have to worry about uniform quality because Phoenix is an old hand at forging and machining the best flanges you can buy. When speedy handling is essential, or you need answers quickly, or you require special service of any type, get in touch with Phoenix. You will like doing business with the alert, fast-moving Phoenix organization.

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Wagner Integral-Type Gearmotor with TEFC motor. Standard or explosion-proof.

Integral-Type Gearmotor protected motor.

For the Power you want - At the Speed you need !

Wherever you need "slower than motor speeds" you can get positive speed reduction with plenty of power by using Wagner Gearmotors.

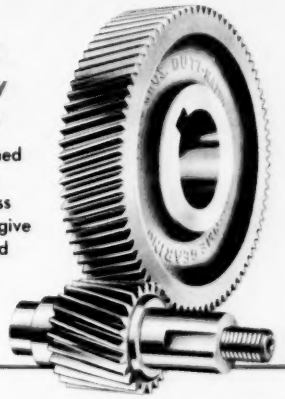
This extension to the Wagner line provides compact motorized drives, with both motor and gear housing of corrosion-resistant cast iron. Available with the latest NEMA Frame open protected or totally enclosed fan-cooled motors, they combine Wagner motor dependability with rugged, simplified gear units to give you speed reduction equipment designed for greater capacity and longer life in ordinary up to rough service.

Wagner Gearmotors offer a wide variety of sizes in single, double, triple or quadruple reductions—horizontal or vertical foot or flange mountings—speeds from 7½ to 780 RPM. Write for Bulletin MU-227.

Whether you specify or apply power transmission equipment, your nearby Wagner Sales Engineer will be glad to help you select the right drive for your applications. There are Wagner Branches in 32 principal cities.

Heat treated high capacity helical gears

Gears are hardened after cutting, for maximum hardness and accuracy, to give extra capacity and longer wear life.



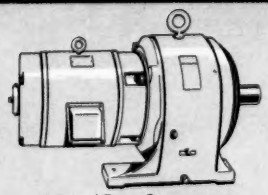
Positive Oil Seals

Improved lip type seals are used on horizontal shafts. On vertical output shafts, double mechanical seal with slinger and drain-off gives positive protection against leakage.

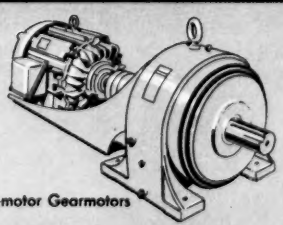
Wagner Electric Corporation

6400 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

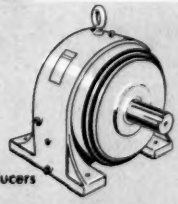
WAGNER SPEED REDUCTION EQUIPMENT



Integral-Type Gearmotors



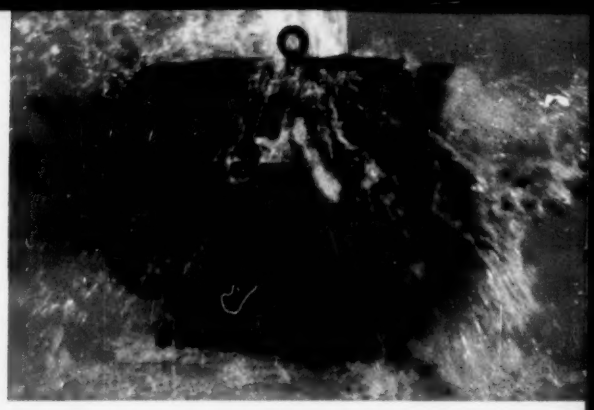
All-motor Gearmotors



Speed Reducers

Shaft-mounted Speed Reducers

DOUBLY PROTECTED. Air intakes and outlets protect against falling or splashing liquids. Cast iron frames protect against rough handling and corrosion.



TYPE DP · Doubly Protected against corrosion · against falling or splashing liquids

These motors give the double protection of corrosion-resistant cast iron frames and dripproof enclosures that are so well designed that they can be used in many applications that formerly required splashproof motors. Available with ball bearings, or with high load carrying capacity sleeve bearings for extra quiet operation. Write for Bulletin MU-223.

1 TO 125 HORSEPOWER – 1750 RPM – 40° C – NEMA FRAMES 182 THROUGH 445U

You get less downtime, lower upkeep, with WAGNER PROTECTED-TYPE MOTORS

If you need motors that will keep production rates up . . . that will give you the continuity of service you want . . . that will operate with complete dependability under the most severe conditions in their specific applications—use Wagner Protected-Type Motors. These motors pack extra power into little space, are light in weight, and are easy to maintain.

Let your Wagner Sales Engineer show you how these protected motors can bring you savings in initial motor costs, maintenance costs, and in continuity of operation.

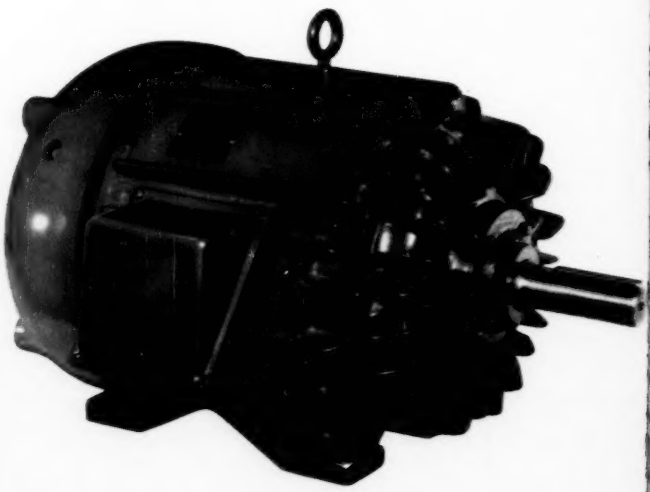
Wagner Electric Corporation
6400 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

WM59-10

1 TO 100 HORSEPOWER – 4 POLE – 60 CYCLE – NEMA FRAMES 182 THROUGH 445U

TYPE EP · Extra Protected against corrosive or abrasive elements

Wagner Type EP Motors are totally-enclosed, fan-cooled—for complete protection against dust, abrasives, fumes, steel chips or filings. Type JP is explosion proof as well—designed and approved for use in explosive atmospheres. Cast iron frames protect against corrosion and ribs on the frames add mechanical strength and increase the surface cooling area. Effective cooling system adds to motor life. Write for Bulletin MU-224.



SECURELY SEALED FOR LOW MAINTENANCE. Both ends of these motors have running shaft seals to keep the heavy duty bearings clean. Bearing housings are effectively sealed to prevent escape of grease. Openings are provided to permit relubrication that adds years to motor life under severe conditions.

. . . DRY JET FUELS

Jet aircraft now get a new and wider safety margin when their fuels are dried with LINDE Molecular Sieves. Even at high fuel flow rates, water normally absorbed at ground level is reduced to less than 10 ppm — eliminating ice-blocked fuel lines at high altitudes.

Liquids never before dried-successfully by desiccants can now be dried commercially with these new zeolite adsorbents. Examples are acetone and other ketones, ethanol and other alcohols, and most saturated and unsaturated hydrocarbons. Drying to less than 1 ppm is now practical in dynamic systems. Due to their high water adsorbing capacity, LINDE Molecular Sieves bring pronounced savings in investment and operating costs.

No matter what the liquid — whether attempts to dry it have succeeded or failed — we would like to discuss with you what a Molecular Sieve design can do.

Write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Address Dept. CE-92.

Linde MOLECULAR SIEVES

UNION CARBIDE

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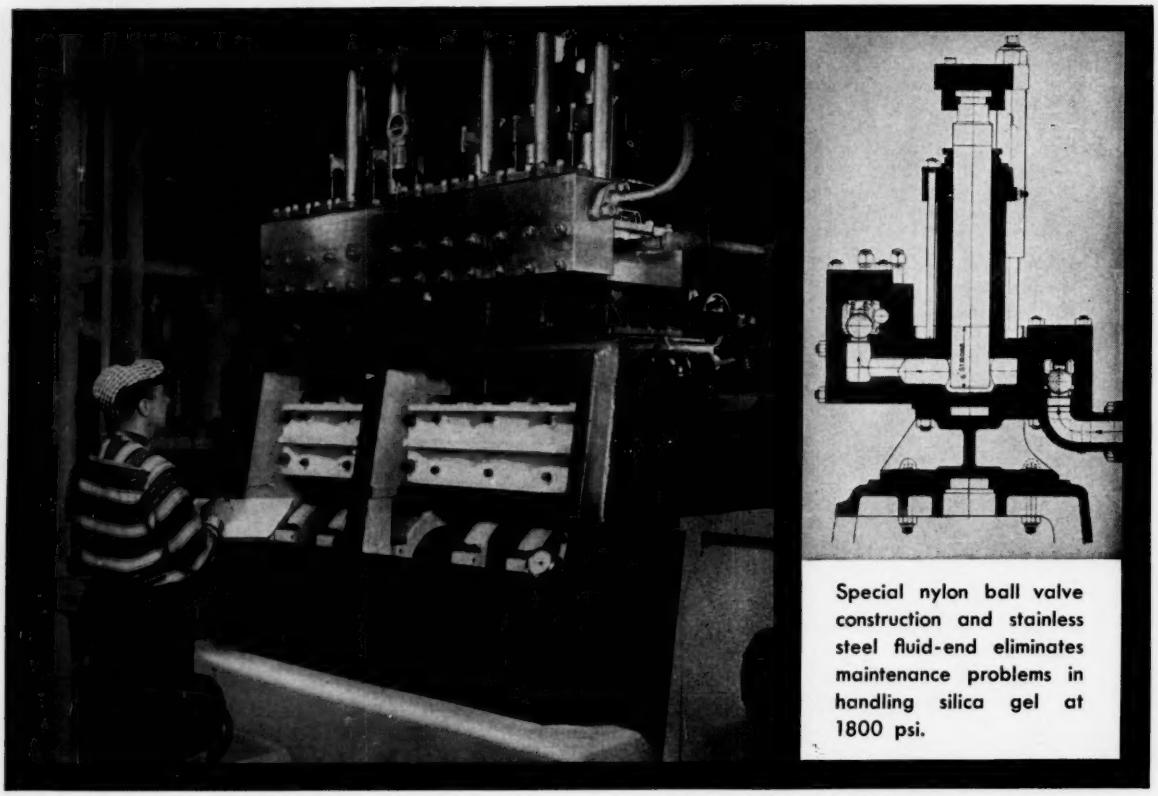
AT DAVISON CHEMICAL LTD.

Aldrich pumps tame highly abrasive, corrosive slurry in high pressure spray drying operation



Special nylon ball valve construction and stainless steel fluid-end eliminates maintenance problems in handling silica gel at 1800 psi.

When Davison Chemical Ltd. built its new plant in Valleyfield, Quebec, for the production of petroleum catalysts, a major problem was to find a pump that (1) had the abrasion and corrosion resistance to stand up in a continuous high pressure process without downtime or excessive maintenance and (2) could maintain the steady pumping pressures necessary to control particle size, density and porosity of the spray dried product.

What was done: Davison Chemical engineers called on Aldrich for help and the result was the special valve design shown. After two years of continuous operation, the Aldrich pumps continue to deliver constant pressure without major overhaul. The General Manager of the plant reports: "We are quite pleased with the performance of these pumps."

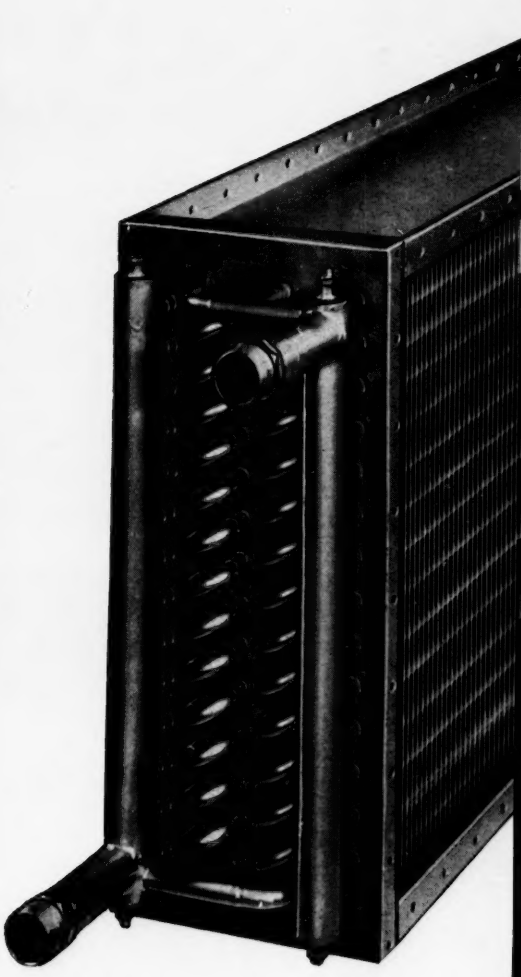
How Aldrich can help you: Solving special pumping problems for the chemical industry is the most important work we do. We would welcome the opportunity to discuss your specific problems . . . no matter what the liquid or slurry, or how high the pressures. Standard Aldrich Pumps range from 25 to 2500 hp. Pressures to 30,000 psi. See our insert in Chemical Engineering Catalog for condensed data. Aldrich Pump Company, 3 Gordon Street, Allentown, Pennsylvania.

the toughest pumping problems go to ALDRICH

STAINLESS STEEL

HEATING AND COOLING COILS

by MARLO



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To Evaporate Liquids

Available with ½", ⅝", or ¾" O. D. Tubes

Coil Assemblies Available Up to 48¾" wide, 26" deep, 14-feet tube length and Fin Spacings of 4 to 10 per inch.

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FOAMGLAS® insulation on these methyl ethyl ketone filters cuts insulation maintenance costs

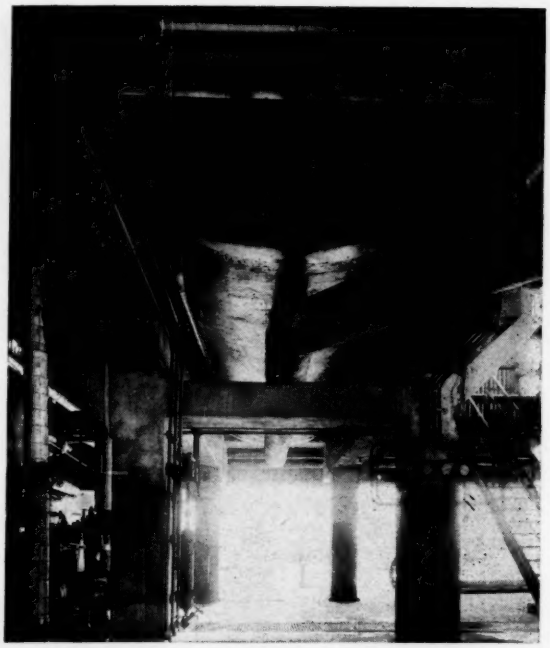
A saving in ketone filter insulation maintenance at the Beaumont, Texas, refinery of Mobil Oil Co. is made possible by the many features of FOAMGLAS insulation.

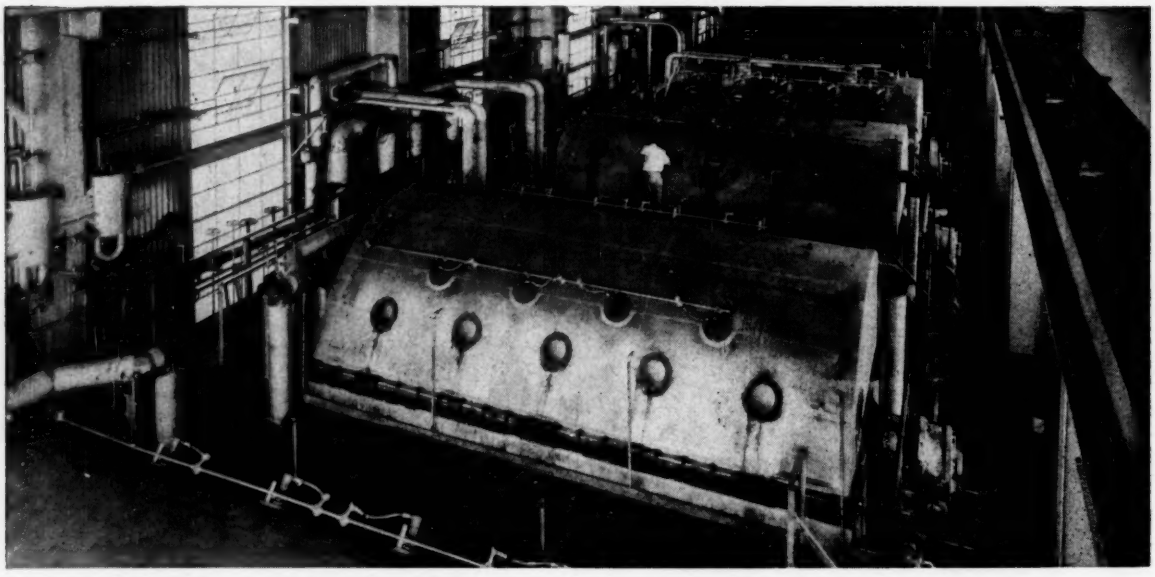
Different operating temperatures for different jobs subject this insulation to constant strain. Filters are chilled anywhere from 40°F. to 0°F., often resulting in ice formation from condensed water vapor. This has damaged insulation materials previously used. But water vapor cannot penetrate the sealed glass cells of FOAMGLAS. There's no crushing "freeze-thaw" cycle within the FOAMGLAS as there is with organic insulations.

Insulation loses much of its effectiveness when it is waterlogged. Not FOAMGLAS, however. Other insulations tried had required frequent maintenance, while FOAMGLAS remains effective for the six years it has been in use. Extremely easy to work with, easy to cut and shape with any sharp tool, FOAMGLAS is impervious to acid . . . even ketone.

Why not find out more about FOAMGLAS insulation? Write for a sample and for information on our two newest products; FOAMGLAS Stay-Dry Pipe Insulation, and new 1¾" FOAMGLAS Roof Insulation. Pittsburgh Corning Corporation, Department H-99, One Gateway Center, Pittsburgh 22, Pennsylvania. In Canada: 3333 Cavendish Boulevard, Montreal, Quebec.

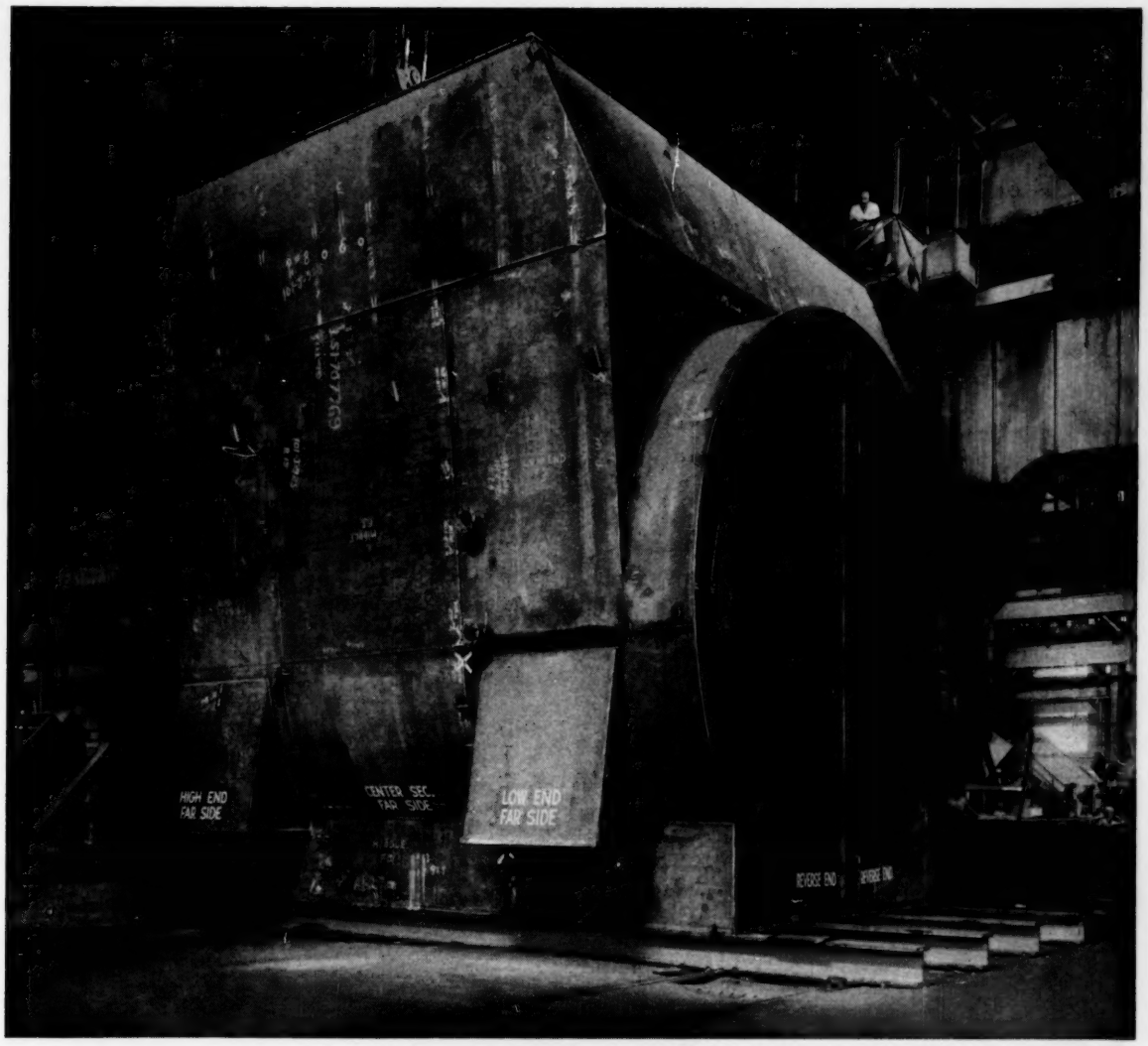
Pittsburgh Corning offers a complete line of mastics, tank coatings and other accessory materials specifically designed for use with FOAMGLAS.





The three filters shown above are typical of filters insulated with FOAMGLAS. These 21' by 11' diameter filters, insulated with layers of 2" and 3" FOAMGLAS, separate wax from oil. The refinery, largest in the Mobil system, has a rated capacity of 220,000 barrels per day.

PITTSBURGH PC CORNING



Operator of overhead crane (top, right) and workmen on shop floor are dwarfed by the enormousness of this surface condenser casing fabricated by B-L-H's Eddystone Division.

No welding job too big for vast B-L-H facilities

No welding job—not even the biggest pressure vessels—is too large for the facilities of Baldwin-Lima-Hamilton's Eddystone Division. The fabricating shop covers 15 acres and is divided into 13 bays, each 80 ft. wide and 600 ft. long.

Sheer size does not, of course, even begin to tell the whole story. From automatic tracer flame cutters to individual hand welders, we have a tool for every conceivable operation. And there is no reason for you to spend money transporting formed parts to Eddystone for welding—or completed weldments to some other shop for machining. We can handle every phase of the job—from design right through to delivery. No wonder so many companies bring the big ones to B-L-H.

Our illustrated Weldment Bulletin 7001 will give you an excellent idea of our vast facilities. You should have it in your files. For a copy, write to B-L-H Corporation, Philadelphia 42, Pa.

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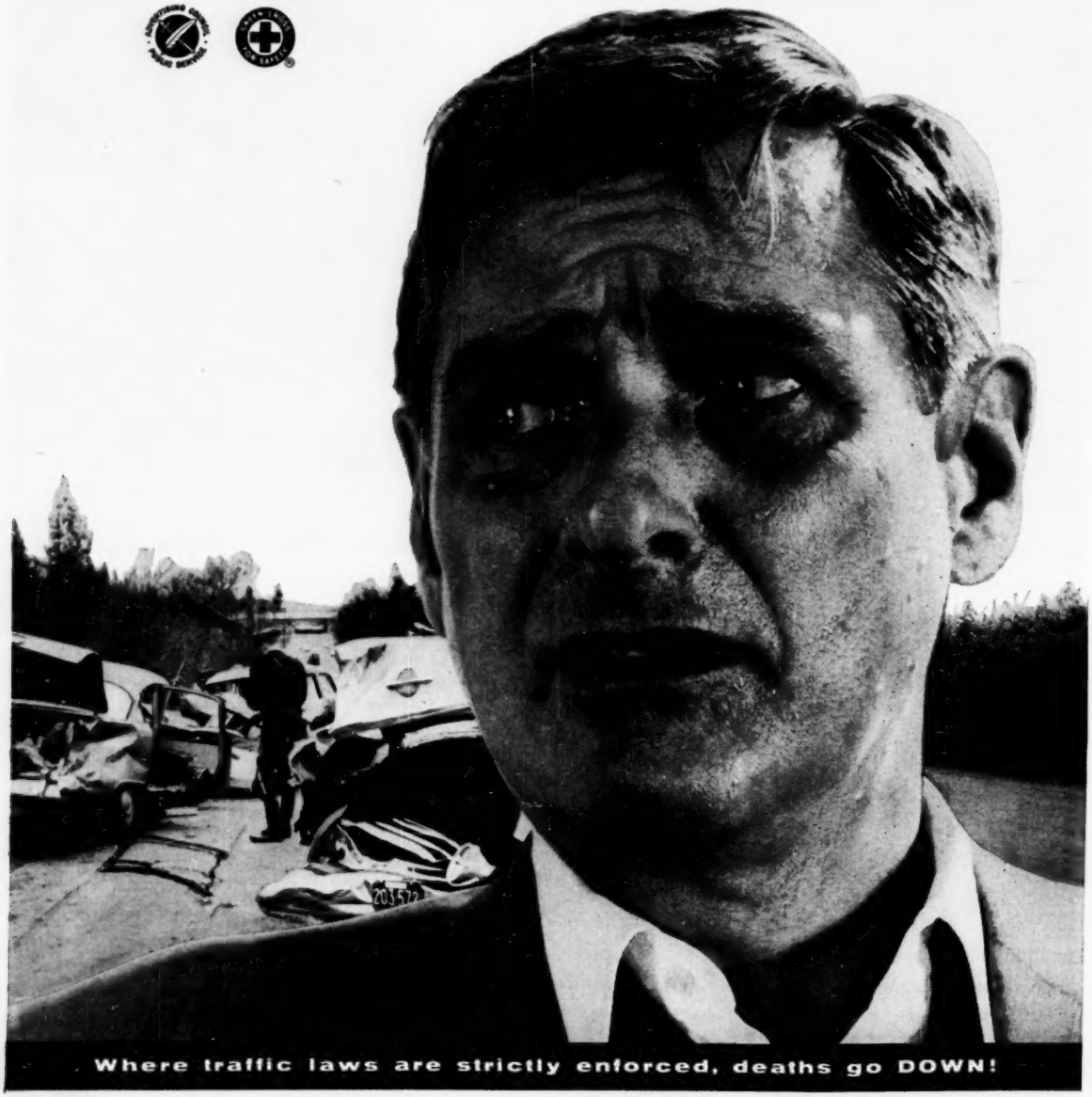
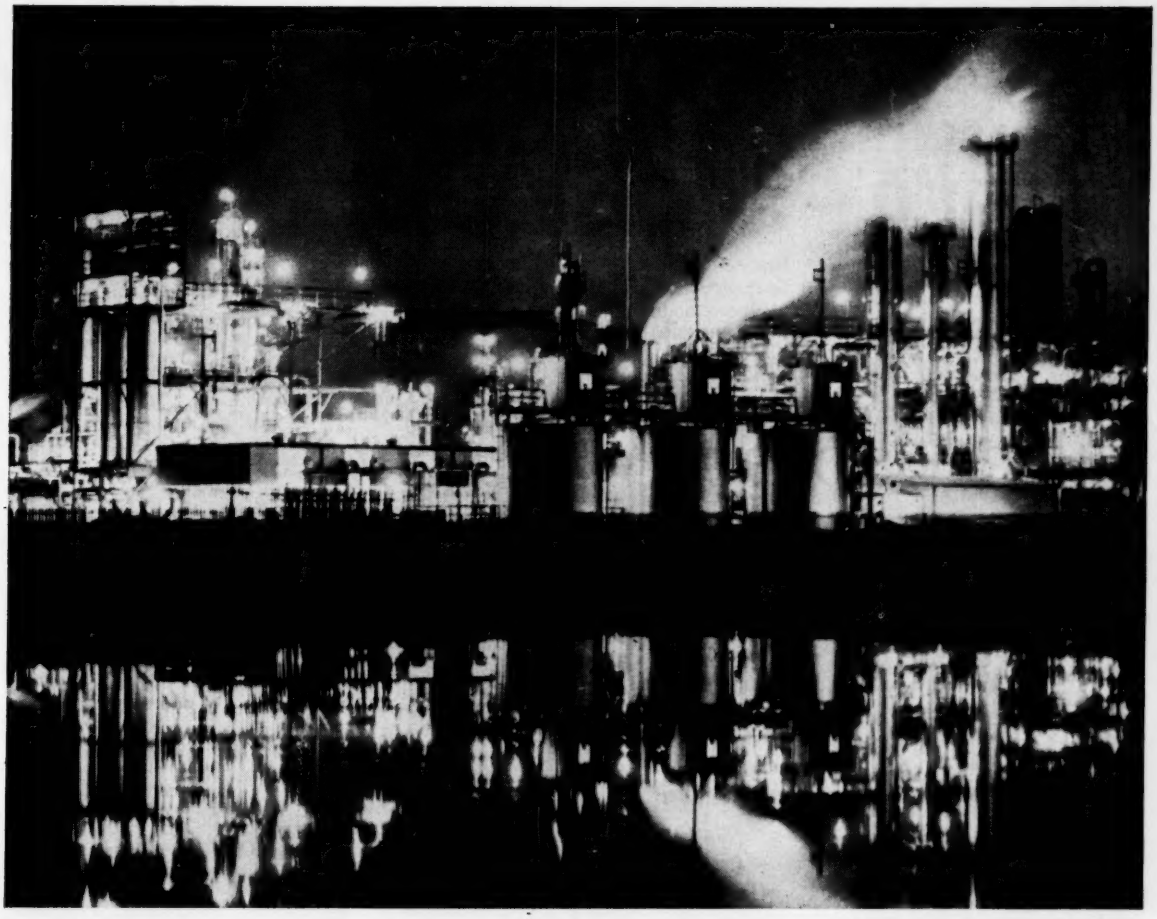
"I wish I could have done something to help . . ."

You can do something about traffic accidents! Drive safely yourself—obey the law. Sure. But you can do a lot *more!* Traffic accidents affect *everybody.* Reducing them is a community problem. Its solution calls for systematic, organized effort and cooperation with public officials—for teamwork and leadership. Here is where *you* can help. Join with others who are working actively to promote safe driving and secure strict enforcement of all traffic laws. Make your influence count. *Support your local Safety Council!*



Published in an effort to save lives, in cooperation with the National Safety Council and The Advertising Council.



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Royal Precision

LGP-30

World's largest-selling engineering and scientific computer

The Royal Precision LGP-30, marketed by Royal McBee, is today helping create new concepts of operating efficiency in many processing industry applications.

The LGP-30 is programmed and operated by the engineer himself to cut through the maze of mathematical computations demanded for peak-level operations. Some examples of the many tasks this machine is now performing are: simple selection of the severity level of the catalytic reformer; most profitable combination of operations in the production, sale and purchase of gasoline, butane, naphtha; computation of heat balances; vapor-liquid equilibria; process simulation; design of heat exchangers, columns and reactors; crude oil evaluation; product yield structure; blending; economic payout determinations.

The LGP-30 is low in cost—about the price of a good engineer—and is simple to program and operate. Its 4096-word memory is comparable to computers many times its size and cost. User-engineers develop a man-machine relationship to the point where the machine becomes an extension of their own thinking capacity. Bolder, more creative engineering almost always results.

No site preparation is necessary. Plug the LGP-30 into the nearest standard outlet and it is ready to go to work. Customers have access to an extensive library of engineering programs and sub-routines, plus the opportunity to join an active users organization.

Royal Precision Corporation

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. LGP-30 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing offices. For complete information on the LGP-30, write **ROYAL McBEE CORPORATION,** data processing division, Port Chester, N. Y.

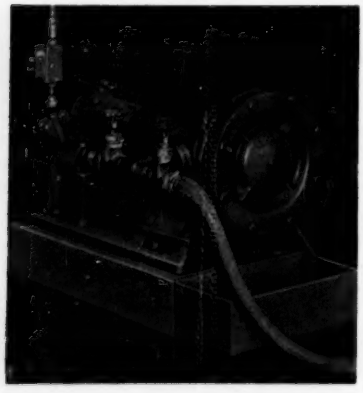
How would you handle an abrasive slurry that erodes metal pumps within *minutes?*

Such a slurry was the problem of Sylvania Electric Products Company at its Danvers, Massachusetts plant.

Extremely abrasive phosphor particles in xylol solution—used to coat the inside of fluorescent lamp tubes—created a tough pumping job: pump life was brief, maintenance heavy, contamination and discoloring a constant problem.

After experimenting with a pneumatic system to handle the material—which proved too costly—Sylvania engineers tested a Goulds-Pfaudler *Glassed* Pump on the job.

Periodic examination over the course of the last two years revealed no wear and no foreseeable difficulties in the future!



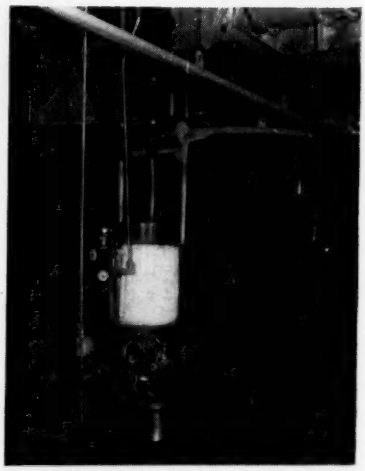
Three more Goulds-Pfaudler Glassed Pumps have since been installed, each of the four running approximately 16 hours a day, 5 days a week without difficulty. Each handles 30 GPM at a head of 30 ft.

Ends product contamination. Because glass is inert and all surfaces of the pump coming in contact with the pumpage are glassed, there is no contamination of the slurry.

Eliminates flammability hazard. With these pumps the system is completely enclosed. Hazardous vapors are not exposed to the atmosphere as they were with the particular pneumatic system used previously.

Reduces production costs. This pumping system does away with the costly pressure vessels, pipes, controls, overflow protection system and the need for a full-time operator required by the pneumatic system. Thus, production costs are lower.

Easy to inspect. Inspection of equipment is simple, fast. Goulds-Pfaudler Glassed Pumps can be inspected just by removing the casing cover, without disturbing pipe connections.



One of four Goulds-Pfaudler Glassed Pumps at Sylvania Electric Products Co. plant at Danvers, Mass.

Goulds-Pfaudler Glassed Pumps may be the answer to *your* tough slurry-handling problem. Write for free descriptive bulletin to: Goulds Pumps, Inc., Dept. CE-99, Seneca Falls, N. Y.

GOULDS GP PUMPS

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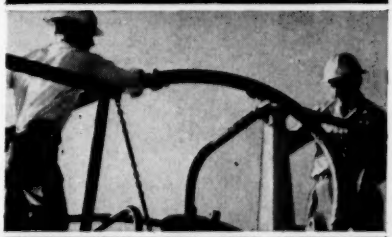

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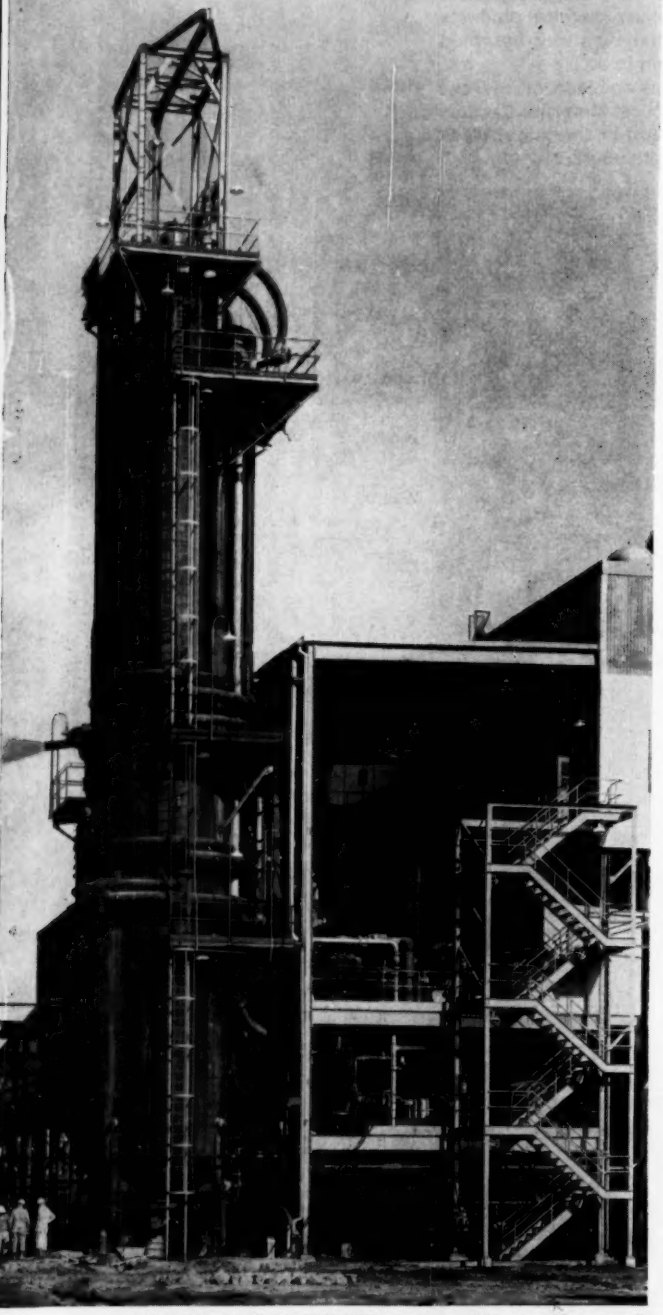
DEVELOPMENTS . . .

PROCESS FLOWSHEET

R. A. LABINE



CONTINUOUS DIGESTER produces 375 tons/day, needs but one operator. Feed vessels are on the right.

Continuous Pulping Is Paying Off

After two years' experience engineers at Gulf States Paper Corp. can cite many savings chalked up by continuous digestion.

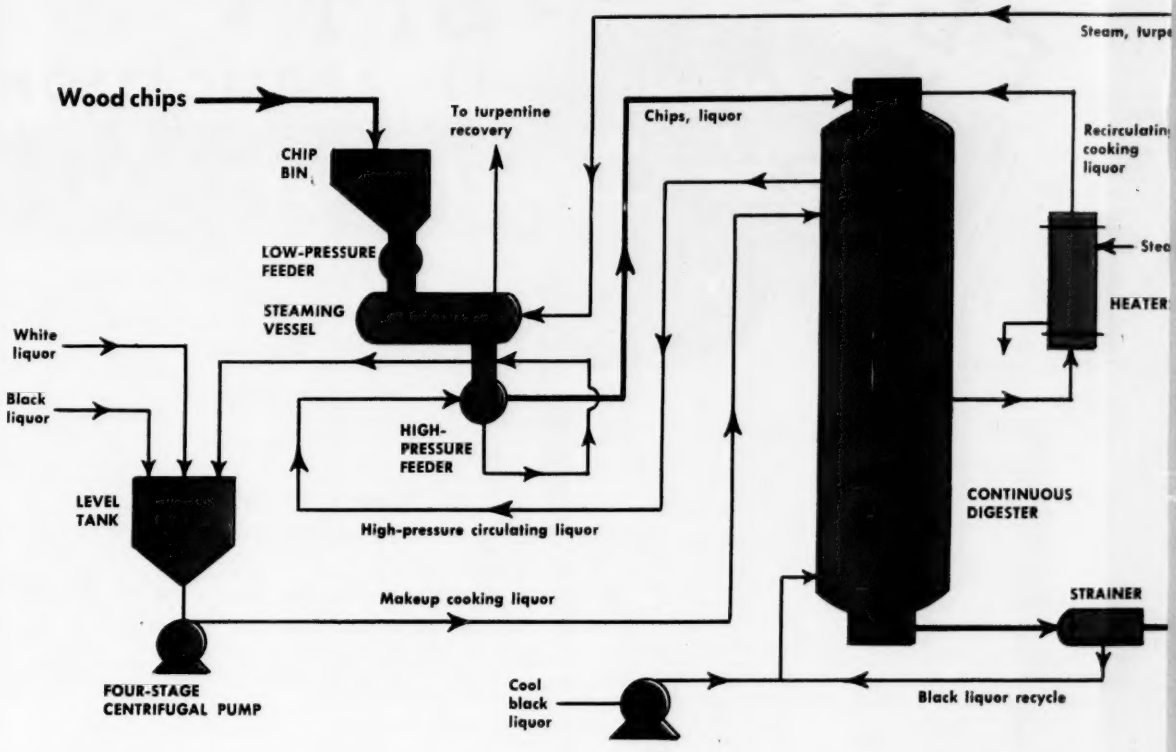
THREE years ago,* *Chemical Engineering* titled an article on the pros and cons of continuous pulp digestion: "Will Pulpers Go Steady?" Today the answer to that question is an unqualified "yes" (see *Chem. Eng.*, July 27, 1959, p. 55).

Case in point: Gulf States Paper Corp.'s new bleached sulfate pulp mill at Demopolis, Ala., that features continuous processing from the time logs enter the chipping station to final packaging of pulp sheet. Heart of this pulping plant is a Kamyr continuous digester, rated at 300 tons/day but which is currently producing 375 tons/day pulp from southern pine and hardwoods.

► **Balance Sheet**—Engineers at Gulf States are high in praise of the $1-million Kamyr unit which has been on stream two years. Not only has it effected the usual economies—investment, space and labor savings along with consistent steam demand—but it is also turning out a premium bleached pulp from southern pine that compares favorably with the best Canadian bleached sulfate

* *Chem. Eng.*, Oct. 1956, pp. 136-138.

Unfold Flowsheet



pulp for burst, tear, fold and refining rate. Credit for this high-quality pulp goes to the "cold blow" process which Gulf States modified from the original Kamyr design.

Chief process evaluation engineer W. R. Adams explains the principle of the cold blow process: "We cool the cooked pulp at the base of the digester before expanding to atmospheric pressure. This prevents mechanical weakening of the fibers which would occur if pulp was passed through the expansion orifice while hot."

▶**How It Works**—Pulp at base of digester (at 335-345 F. and 165 psig.) is cooled by injecting black liquor at 150-200 F. Water is also added to adjust alkalinity. Cooled pulp slurry then passes to a strainer and then to the blow tank.

Flash steam from the blow tank is ordinarily recycled to the chip steaming vessel and turpentine recovered by venting steaming vessel to a condenser. Over 90% of the turpentine (2-3 gal./ton of pulp) comes over in blow steam; very little is distilled from chips in the steaming vessel.

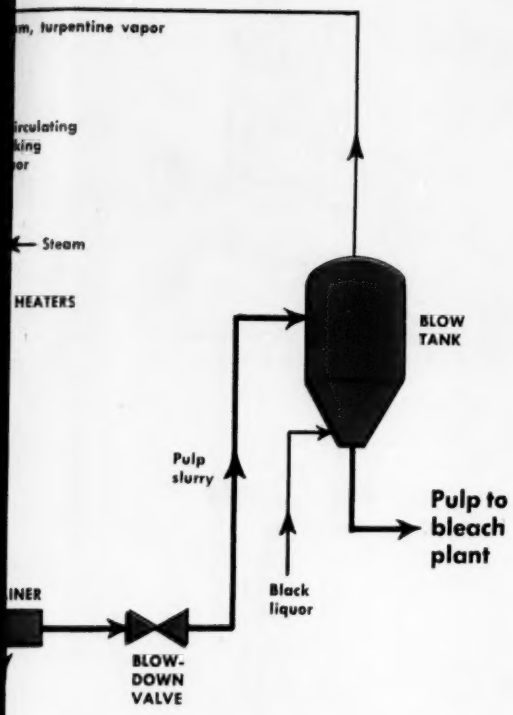
Introduction of the cold blow process with its increased liquor volume and lower blow temperature has prevented utilization of blow steam, however. Process modifications, including extraction of hot liquor directly from the digester, are under way which will get around problems currently requiring venting of blow steam.

▶**Process Flow**—Two duplicate feed systems charge wood chips to the digester, giving an added measure of flexibility in case of mechanical failure or equipment overhaul.

Chips meter through a star feeder into the low-pressure feeder which is a slotted, rotating, tapered plug. Chips drop to the steaming vessel where 13-25 psig. steam drives out inert gases and preheats the chips. After five minutes, chips discharge to high-pressure feeder.

High-pressure feeder is a sophisticated rotating tapered plug with ports extending all the way through—providing a steady flow of chips to the digester. As plug turns, chips are sluiced into vertical port with circulating liquor and then are forced out in the horizontal position with high-pressure liquor.

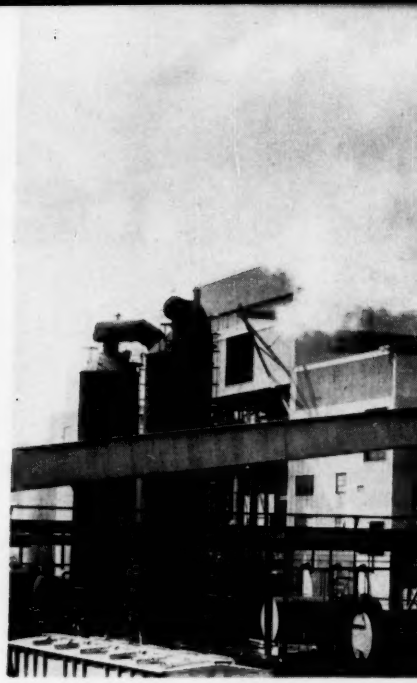
▶**Digester Operation**—Chips and liquor enter digester through a rotating screw which continuously scrapes clean the screen for withdrawing high-pressure liquor.



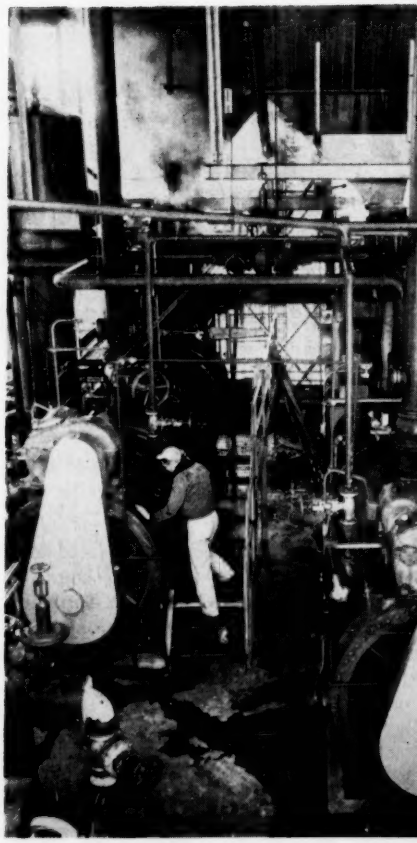
Makeup cooking liquor along with some black liquor enters digester via a four-stage centrifugal pump which maintains operating pressure of 165 psig. Chips flow down past a series of circumferential screen plates where cooking liquor is withdrawn and circulated through steam heaters. Retention time is 2¾ hr. at design capacity with temperatures of 280-310 F. in upper soaking zone and 335-345 F. in lower cooking zone. From digester, pulp passes to the blow tank and then to a standard chlorine-chlorine dioxide bleaching system.

Gulf States' digester is 80 ft. tall and 13 ft. dia., fabricated from mild steel. Only major corrosion problems have occurred in the external liquor heaters on the digester. These three units (two on stream, one on standby) carry a high liquor load and have to be acid-cleaned every two weeks. Type 304 stainless steel tubes, which had been failing from stress corrosion, are being replaced by Inconel tubes.

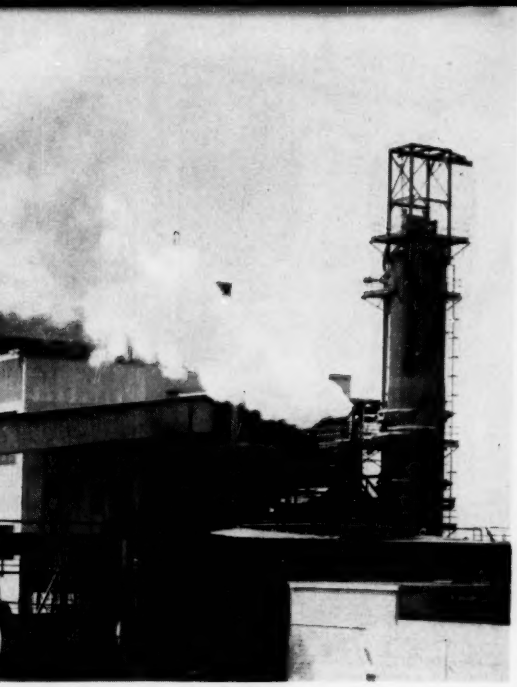
Successful digester operation confirms that consistently uniform, high-quality pulp be produced in a continuous unit with accurate control of cooking conditions.



CONVEYOR carries wood chips from the ch
the background is the bleach plant with t

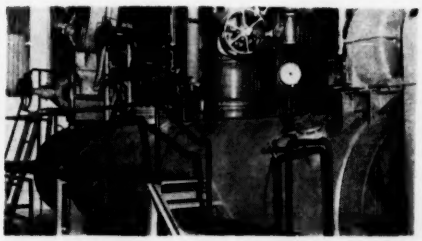


STEAMING VESSELS receive chips from
background, preheat chips for 5 min. with 2

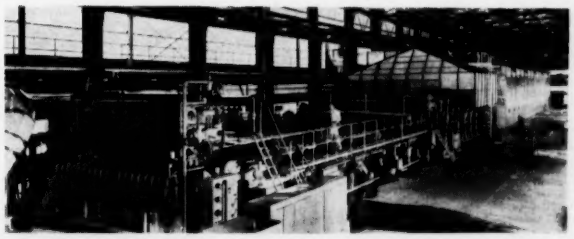


he chipping station to the digester's two feed bins. In
ith two chlorine dioxide bleaching towers on the left.

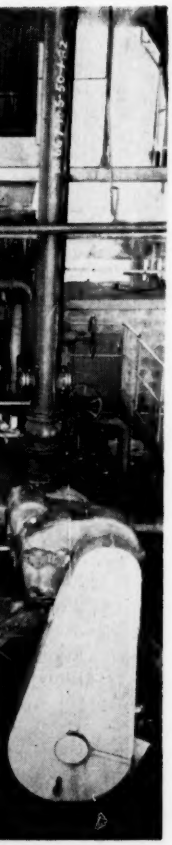
LIME KILN, causticizers in the chemical recovery plant with evaporators and boiler in background.



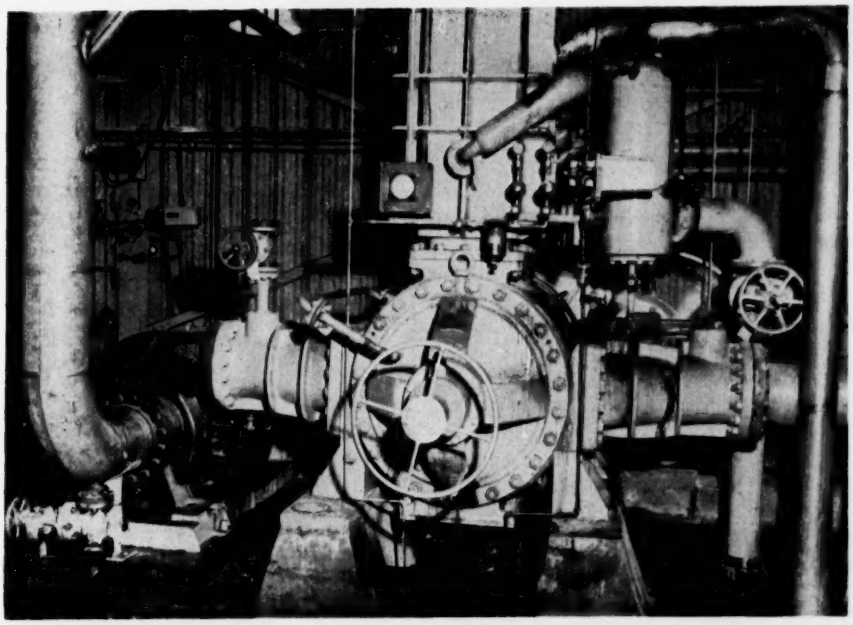
CLOSEUP shows detail of steaming vessel.



PULP MACHINE forms pulp slurry into sheet for shipping.



from bins in the
ith 20 psig. steam.



HIGH-PRESSURE FEEDER receives chips from the steaming vessel in top port. As plug turns, 165-psig. liquor in line at the left forces chips out and into the digester.

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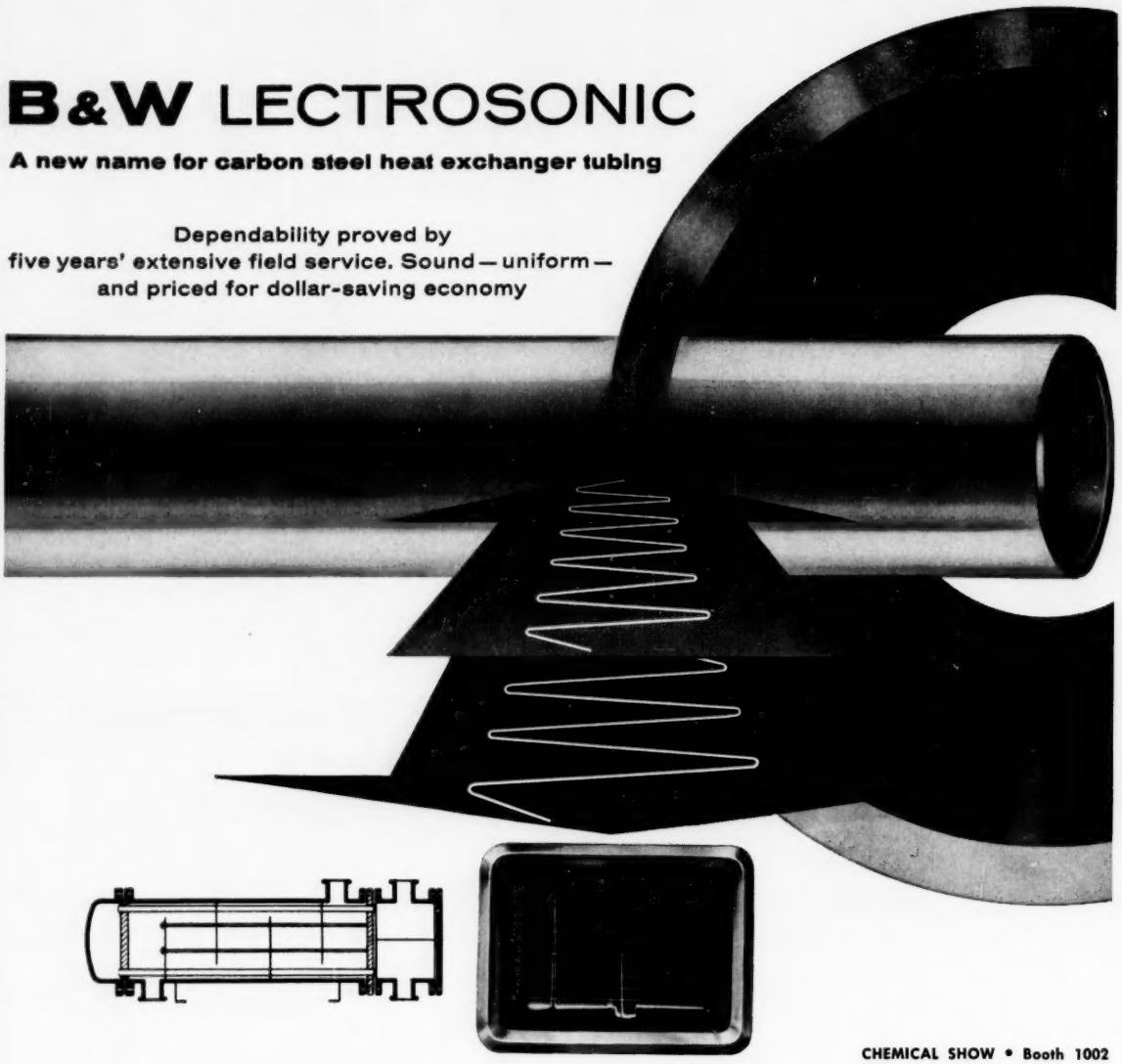

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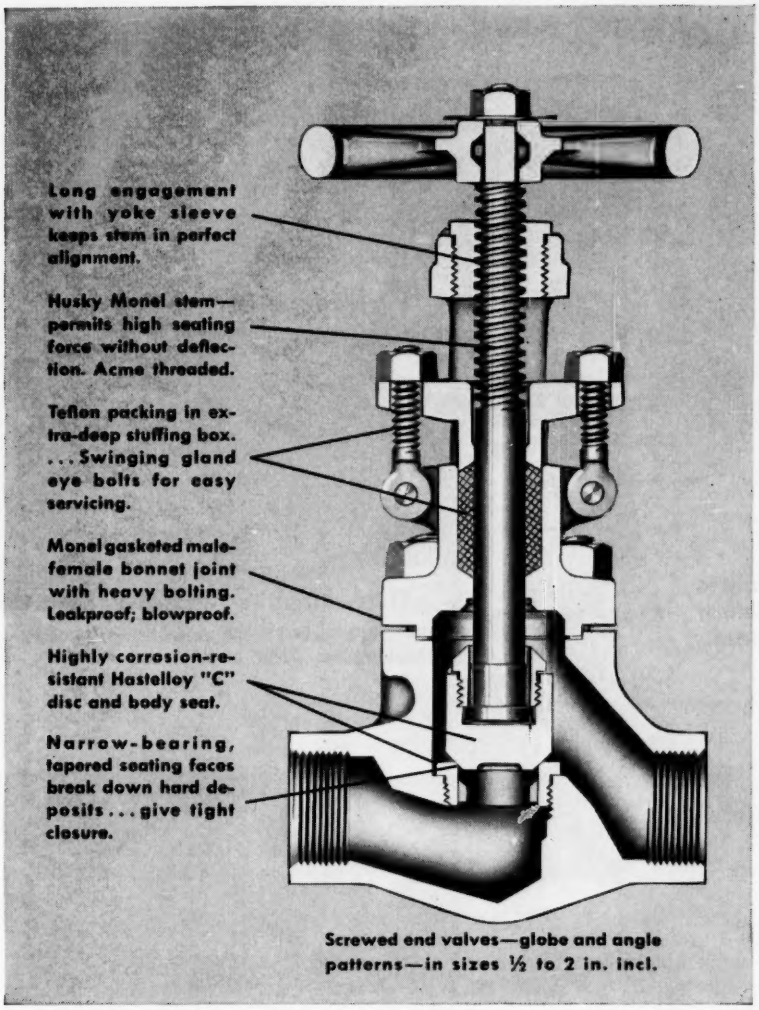
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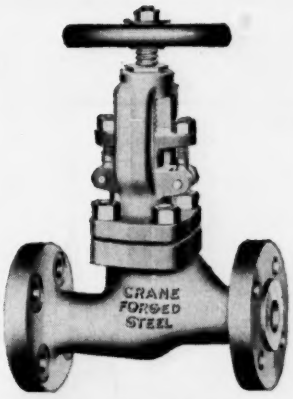
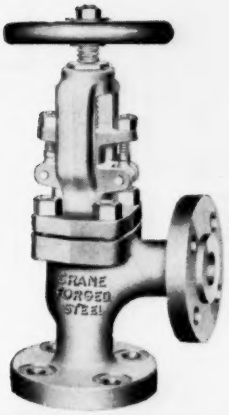
Husky Monel stem—permits high seating force without deflection. Acme threaded.
Teflon packing in extra-deep stuffing box. . . . Swinging gland eye bolts for easy servicing.
Monel gasketed male-female bonnet joint with heavy bolting. Leakproof; blowproof.
Highly corrosion-resistant Hastelloy "C" disc and body seat.
Narrow-bearing, tapered seating faces break down hard deposits . . . give tight closure.

Screwed end valves—globe and angle patterns—in sizes ½ to 2 in. incl.



Flanged end globe valve—in sizes ½ to 6 in. incl.



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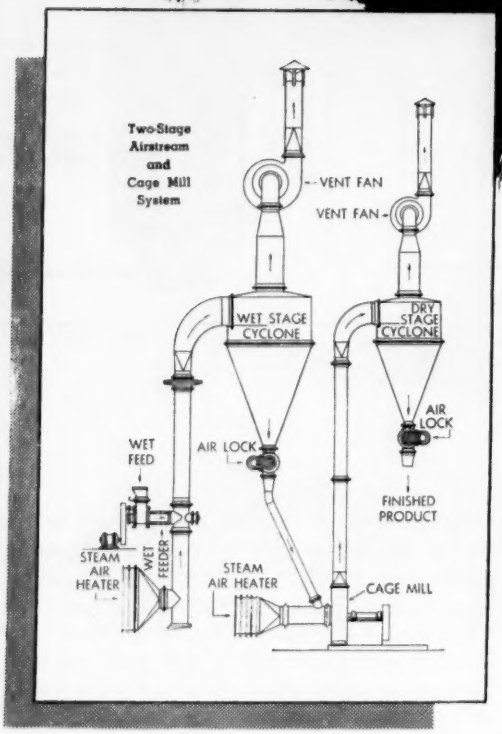

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Flash Drying and Pulverizing **—with the Imp Mill**

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Flash Drying by Airstream **—without Disintegration**

Flash Drying by Multi-Stage System **—combination of Airstream and Cage Mill**

IF there is any phase of your manufacture that requires the drying of materials in finely divided form, *Raymond Flash Drying* offers advantages, which will simplify the process, improve the product, reduce operating and maintenance costs.

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RAYMOND Flash Drying Bulletin #85

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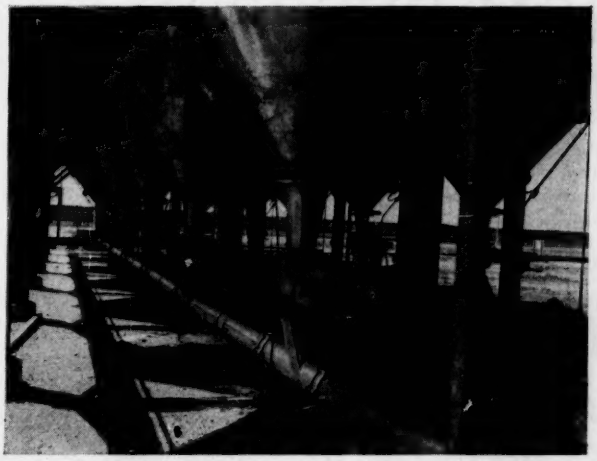
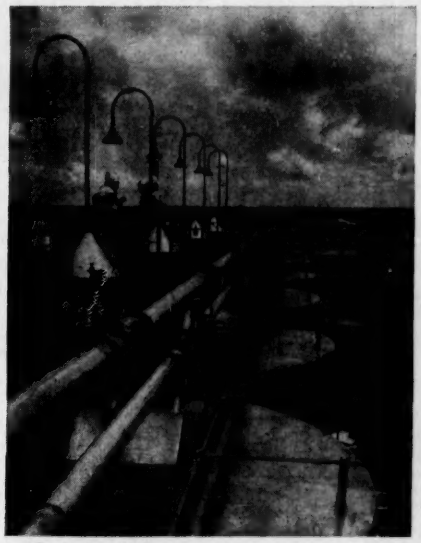


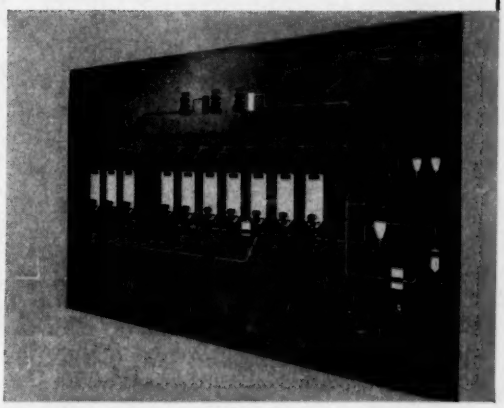
1. Installation at an ultra-modern plant of one of the largest companies in the chemical field. Shown are storage bins with airtight automatically operated discharge gates.



3. Series of bins served by pneumatic conveyor systems with diverter valves.

2. Transfer station, handling polyethylene pellets at rates of 60,000 lbs. per hour, receives materials delivered from any one of several points under vacuum; transfers them to the pressure side of the system for delivery to any one of several discharge points.

4. Graphic control panel built for explosion-proof service. Permits operator to direct flow of materials through proper channels from one central location.



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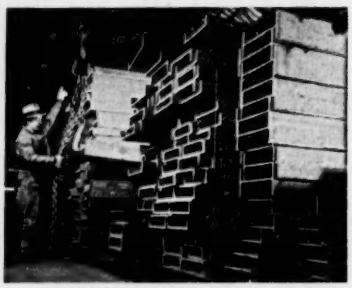

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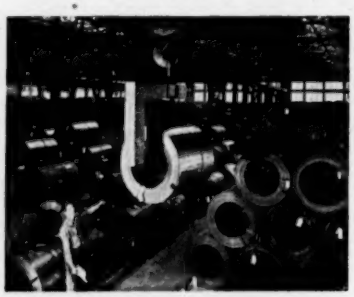

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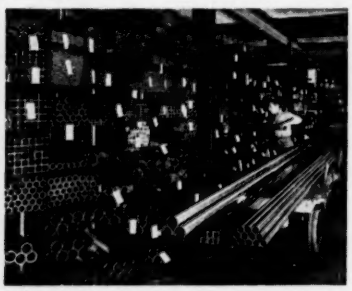

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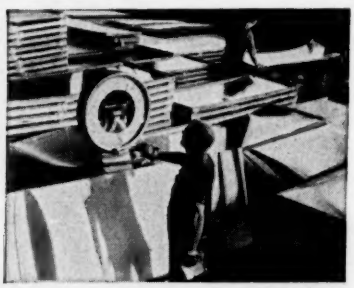

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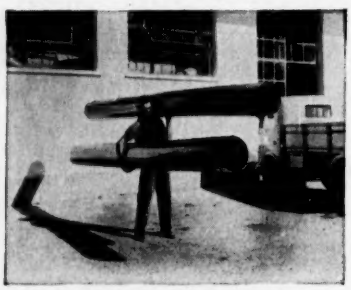

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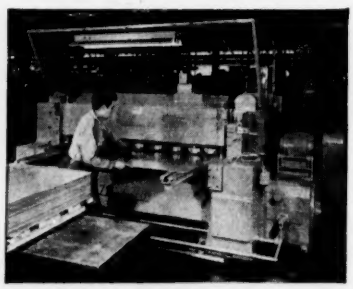

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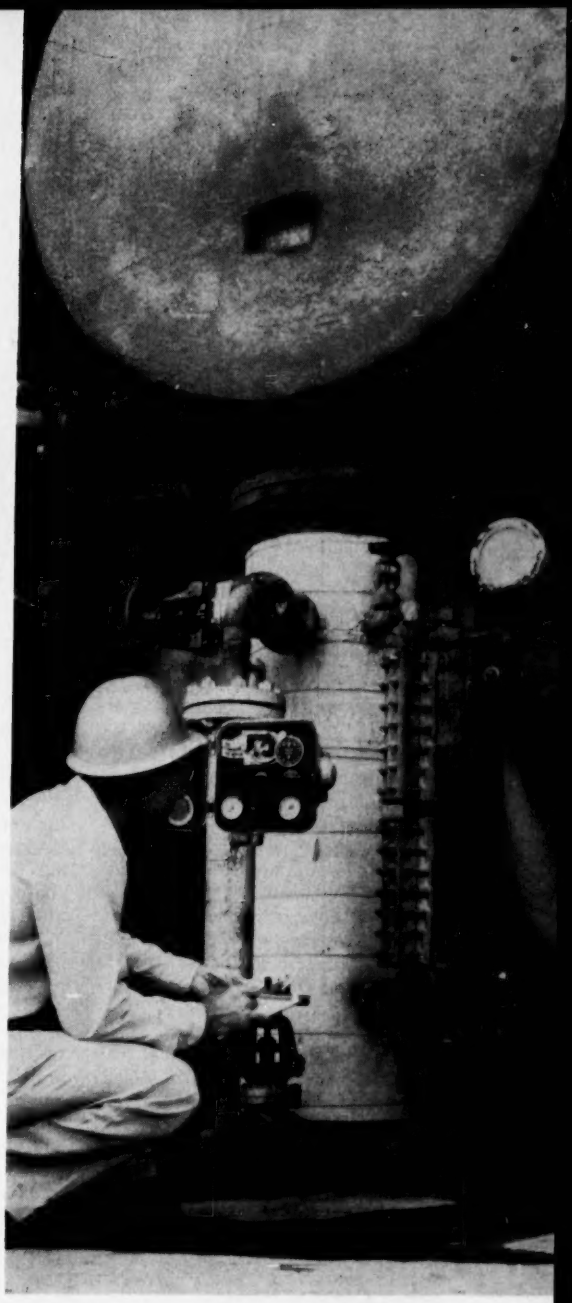
Chemical Engineering

SEPTEMBER 21, 1959

Better Control of Heat Exchangers



Six schemes covered make this a handy heat exchange control primer.

CARL W. SANDERS,
DuPont Co., Wilmington, Del.

HEAT EXCHANGE, as a unit operation in the process industries, is of universal importance. And proper operation of exchangers usually means proper control.

We're concerned, in this article, with application engineering information on automatic temperature control of exchangers.*

The Usual Way

The normal method for controlling a heat exchanger is to measure exit temperature of the process fluid and adjust input of the heating or cooling medium to hold the desired temperature (Fig. 1).

To stabilize this feedback control, in almost all cases the controller must have a wide proportional band (i.e., a wide range of exit temperature change operates the control valve through full stroke). The proportional band is determined by gain of other components in the control loop and by process considerations. It is an exception when the usual combination of conventional control elements permits use of narrow-band control mechanisms.

Since heat-exchanger control requires a wide proportional band for stabilization, reset response (rate of change of heating medium flow proportional to exit temperature deviation from controller set point) is normally required to correct for offset in the controlled variable (temperature), if there are process load changes. Reset response can be eliminated in cases where disturbances—such as steam header pressure, product flowrate or inlet temperature changes—have small effects relative to desired tolerance on the controlled variable.

When throughput to a heat exchanger is changed rapidly, a short-term error in control temperature results. The magnitude and duration of this error can normally be reduced by a factor of two by adding derivative response to the control mechanism and adjusting it properly.[5] In derivative response, heating fluid flowrate is proportional to rate of change of temperature deviation from the set point.

Faulty temperature-sensing element or valve specification detracts from system perform-

*For help with a specific application, reference should be made to the more rigorous and quantitative treatments given in Refs. 1, 2, 3, 5, 6.

ance and may result in costly design changes of other parts of the exchanger system.

Install Thermal Elements

Temperature-sensing (thermal) elements in a heat-exchanger installation should be placed as close as possible to the active heat exchange surface, consistent with requirements for adequate mixing of the process stream. When point of measurement is moved from the active heat-exchange surface (e.g., thermal element installed several feet downstream of the exchanger in the process pipeline), a time delay is introduced in the control system.

This time delay (or distance-velocity lag) has a particularly noticeable effect on control performance. A distance-velocity lag rapidly introduces phase-shift with little signal attenuation. A 5-ft. length of pipe in which line velocity is 5 ft./sec. produces a distance-velocity lag of 1 sec. which can be one of the dominant time constants limiting dynamic performance of the heat-exchanger control system.

Time response of a thermal element installed in a thermal well is much slower than when the thermal element is installed bare. Thermal wells should be omitted where control performance is critical providing installation without a well is practical from a maintenance and safety standpoint. When a thermal well is used, particular care must be taken to minimize the effect of air gap between thermal element and thermal well by proper installation of conducting sleeves.

Select Control Valves

Valves for the normal heat-exchanger application should be provided with positioners. Valve friction materially detracts from system performance. If there is a question about performance of a new installation, or if performance requires improvement of an existing installation, it is generally desirable to use a valve positioner to eliminate the effects of valve friction.[4]

It's desirable to maintain the same relationship between incremental changes in valve opening and changes in measured temperature for various throughput rates so that gain of the control system remains reasonably constant. Satisfying this condition results in better control over the range of throughput rates. When throughput doubles, twice the incremental change in flow of heating or cooling medium is required to produce a given change in temperature.

Equal-percentage valve trim produces flow at constant pressure drop which varies as a function of $F_m x^2$, where F_m is maximum flow in the open position of the valve and x is fractional opening of the valve. The slope of flow change *vs.* valve opening is proportional to the opening of the valve (i.e., $dF/dx = 2F_m x$). Use of equal-percentage trim, therefore, normally results in holding constant the relationship between valve movement and temperature change.[5]

Changes in pressure drop across valves used in steam heating service must be considered when overall valve characteristic is determined, because back pressure from the heat exchanger normally changes over a significant range for various process load changes.

Frequently, a low supply pressure, relative to maximum operating pressure of the heater, must be used as a result of sizing the heat exchanger for minimum heat-exchange surface area. When this is the case, difficulty in stabilizing the system at low operating rates may be encountered. Equal-percentage trim should be used, sized for maximum allowable pressure drop at full load. Let's examine the importance of sizing and selection to accommodate the wide rangeability that may be encountered.

Normal Control Regulates Input Heating Medium

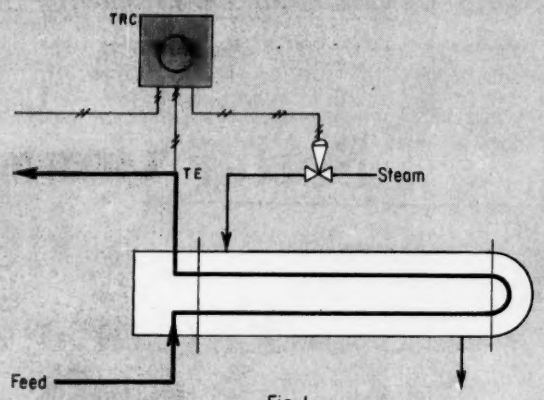


Fig. 1

At full rate, heater load is 1,000 lb./hr. of steam; heater shell pressure is 95 psig. At low rate, heater load is 200 lb./hr. of steam; heater shell pressure is 50 psig. At full load, available pressure at the valve is 100 psig.

Using valve-sizing equations,[3] size C_v for 1,250 lb./hr. of 100 psig. saturated steam at 5 psi. pressure drop.

$$C_v = WK/3\,(\Delta P \times P_2)^{1/2}$$
$$= 1{,}250/3\,(5 \times 109.7)^{1/2}$$
$$= 41$$

To compute the maximum flow that this valve passes at low-load pressure drop of (100 −50) = 50 psi.,

$$W = 3C_v\,(\Delta P \times P_2)^{1/2}/K$$
$$= 3 \times 41\,(50 \times 64.7)^{1/2}$$
$$= 7{,}000 \text{ lb./hr.}$$

The required low-rate flow is 200 lb/hr. or 100(200/7,000) = 3% of the flowrate which this valve can pass at 50 psi. drop, if wide open.

This 3% flow requires 10% opening of an equal-percentage valve having a 2% clearance flow.[3] This compares to 60% opening of the valve if pressure drop at low load were held to 5 psi. Thus, the gain of this valve departs significantly from that desired.

Another unwanted effect occurs because at low flow the valve operates near the clearance flow point where slope of flow *vs.* opening changes abruptly in an adverse di-

Simple Alternative Control Throttles Condensate

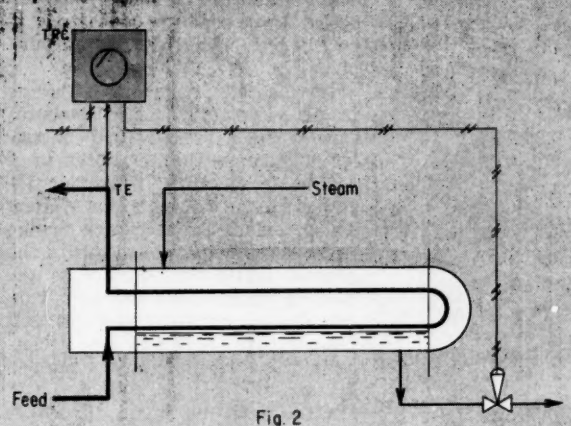


Fig. 2

Cascade Control Provides Rapid Recovery to Upset

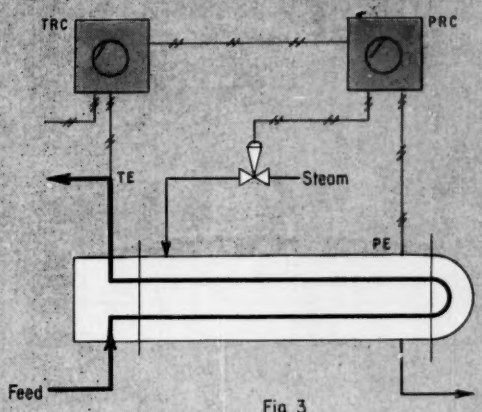


Fig. 3

rection. Best control at the low operating load can be obtained if a separate control valve is used, sized to preserve an effective system gain.

Other Control Schemes

In some cases, investment in control equipment for steam-heated shell-and-tube exchangers can be reduced by placing the control valve in the condensate line rather than in the steam line (Fig. 2). This control is not as responsive as the system previously described and, in general, should not be used on critical process applications unless tests can be made to confirm operability of the system. It should be employed only where a special inherent advantage accrues. The behavior of this control system is quite difficult to predict.

A pressure cascade control system (Fig. 3) cascades output of a standard three-action temperature controller into the set point of a pressure controller. It achieves a more rapid recovery to process load disturbances in a shell-and-tube exchanger than can be obtained without the pressure controller. Steam to the heater is regulated by the pressure controller which is normally provided with proportional and reset responses. Load change is rapidly sensed by a change in shell pressure which is compensated for by the pressure controller. The temperature control system senses the residual error and resets the pressure control set point.

Bypass Improves Control of Slow-Response Exchanger

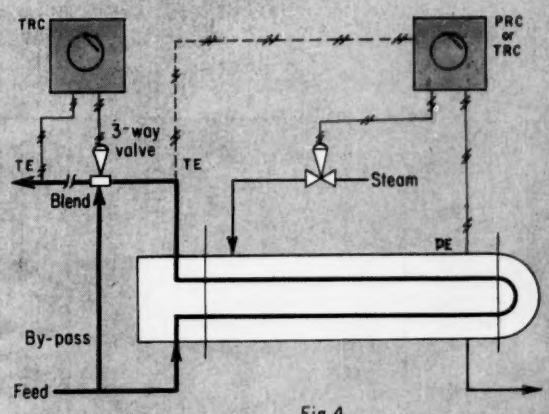


Fig. 4

In certain cases, the time response characteristic of a heat exchanger is too slow to hold temperature deviations resulting from load changes within desired tolerances. In some of these cases, the transient characteristics of the heat exchanger can be circumvented by bypassing the heater with a parallel line and blending cold process fluid with hot fluid from the heater (Fig. 4). In the bypass system care must be taken in sizing valves to obtain the desired flow split with adequate flow *vs.* stem travel characteristic. Thermal element response time is particularly important since this time constant is a major factor influencing performance of the system.

In some liquid-to-liquid heat exchangers, particularly plate exchangers, heavy metal sections increase thermal capacity on the supply side of the heat exchanger. For control, heating or cooling fluid is

Control of External Heating Provides Better Response

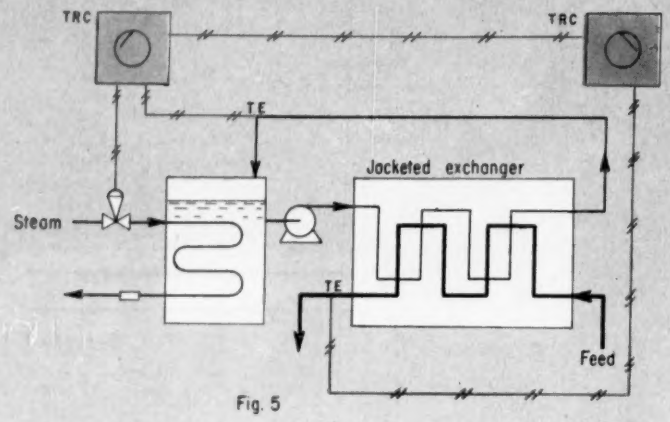


Fig. 5

Condensate Level Control Raises Shell-Side Pressure

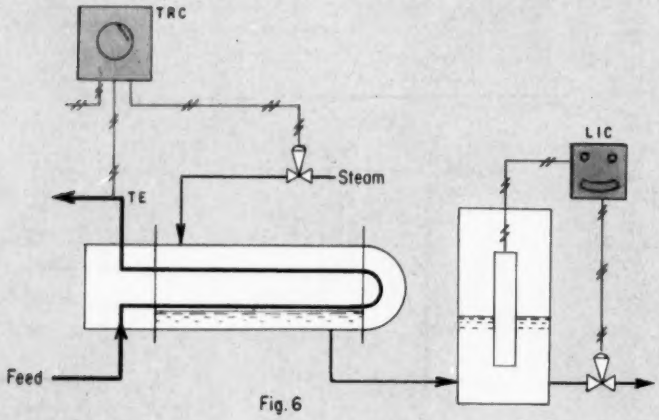


Fig. 6

recirculated through the heat exchanger and is externally heated or cooled by a separate system or it may be blended with a make-up supply (Fig. 5).

In this recycle system, a change in process liquid outlet temperature causes a temperature controller to change the set point of a second temperature controller installed in the recirculation system. This provides the necessary change in heat exchange rate to return the process liquid temperature to the desired value. This cascaded control system normally controls exit temperature within closer tolerances than the single control-loop system.

Care must be taken to assure that condensate removal systems for steam-heated exchangers are adequately designed for the particular installation. Traps should be selected which do not intermittently introduce disturbances of sufficient magnitude to upset shell-side pressure as a result of rapid condensate dumping. Disturbances of this nature cause upsets in temperature of the controlled process stream.

Steam heat-exchanger traps should discharge into condensate collecting systems held at pressures below the lowest shell-side operating pressure.

In situations where minimum condensing pressure might otherwise be lower than condensate system pressure, the surface of the exchanger can, in some cases, be reduced by holding a condensate level within the heat exchanger as shown in Fig. 6. An external level tank with level control is required for this system.

The assistance of M. J. DePasquale of M. W. Kellogg Co. is gratefully acknowledged.

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Meet Your Author

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For "Quick and Dirty" Calculations of . . .

- Pipe Size
- Pump Power
- Vessel-Head Volume
- Flow-Rate Conversion
- Heat Exchanger Costs
- Control Valve C_v's

Use These Computation Shortcuts

SY H. FRIEDMAN, Senior Engineer, Bechtel Associates, New York, N. Y.

EVERY chemical engineer, at one time or another, is faced with the necessity of producing a rough figure in minimum time without the aid of handbooks and tables. Such a figure might be required as a rough check on more sophisticated calculations, or as an estimate for preliminary "round-table" discussions on proposed engineering projects.

It might even be advantageous to have handy a quick calculation method for use in so simple, yet often frustrating, an operation as locating the decimal point following a long series of complicated slide-rule computations.

Here are some quick calculation methods which will yield "ball-park" figures in minimum time. Results obtained through these methods should be used for rough estimate purposes only, as outlined in the paragraph above. These figures should never be used as a substitute for more rigorous means of obtaining the desired information.

Economic Pipe Sizing

Here is an equation that will produce the proper pipe size for a particular liquid mass-flow rate, without the necessity for calculating Reynolds number, friction factors, pressure drop, or viscosity. This equation, limited to single-phase, turbulent flow in standard pipe (iron, steel, etc.) greater than 1 in. in diameter, is:

$$d = 0.1\sqrt{\frac{W}{\rho}} \qquad (1)$$

where d = diameter of pipe, in.; W = flow of liquid, lb./hr.; and ρ = density of liquid, lb./cu. ft.

The equation is based on a mean fluid velocity of 5.09 ft./sec. If a higher or lower velocity is desired, it is necessary to multiply the right-hand side of the equation by $(5.09/V)^{0.5}$ where V is the desired velocity in ft./sec. The equation is derived as follows:

Velocity of a liquid flowing through a pipe can be obtained by dividing the mass of fluid flowing, per unit time, by the cross-sectional area of the pipe:

$$V = \left(\frac{W}{\rho}\right)\Big/\left(\frac{\pi D^2}{4}\right)$$

Correcting for consistency in units:

$$V = 0.0509\frac{W}{\rho d^2}$$

Rearranging:

$$d^2 = 0.0509\frac{W}{\rho V}$$

Fluid velocities of from 8 to 10 ft./sec. are considered maximum for economic line sizing. Except for pump suction lines, where NPSH is the controlling factor, velocities below 2 ft./sec. are not economical. Therefore, the economical range of fluid velocities for any pipeline can be considered to lie between 2 and 8 ft./sec. The mean of these extremes is 5 ft./sec. Since the constant in the equation above is fortuitously 0.0509, it is convenient to assume the mean velocity to be 5.09 ft./sec.; then, substituting for V,

$$d^2 = \frac{0.0509W}{5.09\,\rho}$$

Therefore:

$$d = 0.1\sqrt{\frac{W}{\rho}} \qquad (1)$$

Centrifugal Pump Horsepower

Here is a quick method for determining brake horsepower for a centrifugal pump when there is no formula handy or only a very rough approximation is desired in a hurry. Divide the product of the pump output in gallons/minute and the head in pounds/square inch by 1,000.

$$\text{Bhp.} = \frac{\text{gpm.} \times \text{psi.}}{1{,}000} \qquad (2)$$

Eq. (2) is based on the relationship:

$$\text{Bhp.} = \frac{\text{gpm.} \times \text{psi.}}{1{,}714 \times \text{Pump Eff.}}$$

If a pump efficiency of 58.3 is assumed and used in the second equation, the denominator becomes 1,000, yielding Eq. (2). A properly designed and well maintained pump operating at or near its rated ca-

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SY H. FRIEDMAN is senior engineer in the process department of Bechtel Associates. A licensed engineer in New York, he is a member of the N. Y. Society of Professional Engineers. This article is Mr. Friedman's third for *CE*.

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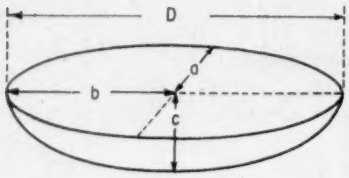
Ellipsoidel Vessel-Head



pacity will have an efficiency of between 70 and 80%. The use of Eq. (2) in this case will give a conservative approximation of the brake horsepower. However, a chemical pump in the usual plant will have an efficiency more closely approaching 60% in which case Eq. (2) will yield a fairly good estimate of the brake horsepower.

Heat Exchanger Costs

There are several methods available for estimating quickly the approximate costs of heat exchangers. Here is yet another which may be applied to exchangers operating at less than 800 psi., constructed of standard materials, and with heat transfer duties in excess of 1,000,000 Btu./hr.

Assuming a $U\Delta T$ of 6,000 and a cost of \$6/sq. ft. of heat exchange area, the purchased cost in dollars will be the duty divided by 1,000. Reducing the above statement to a formula, we have:

$$\text{Cost, \$} = \frac{\text{Duty (Btu./hr.)} \times \$6/\text{sq.ft.}}{6{,}000\ \text{Btu./(hr.) (sq.ft.)}}$$

which becomes:

$$\text{Cost, \$} = \frac{\text{Duty}}{1{,}000} \qquad (3)$$

The use of 6,000 for $U\Delta T$ is based on a U of 50 to 200 and a ΔT of 50 to 200. Experience with heat exchanger design indicates 6,000 for $U\Delta T$ as a reasonable average for all but liquid-liquid inorganic-water exchange at high ΔT's. In the latter case, a $U\Delta T$ of 10,000 would be preferable.

High-pressure operation, requiring heavier, more expensive construction, and the use of costly alloys, will increase the cost per square foot and make Eq. (3) inapplicable. However, it is obvious that by multiplying the righthand side of Eq. (3) by the ratio of actual estimated cost per square foot to the assumed cost of \$6/sq. ft., an approximate purchased cost for more expensive heat exchangers can be obtained.

Volume of Elliptical Heads

There are many excellent tables and charts for obtaining the volume of elliptical heads. However, when you need the volume quickly and no charts or tables are readily available, just cube the inside diameter in feet to obtain the volume in gallons. Here's why:

A 2:1 elliptical head is one-half a spheroid with the minor axis, by definition, one-half the major axis. The relationship of the three semi-axes of the head is as shown in the diagram. Now, by observation, $a = b = D/2$. Also, for the 2:1 ellipsoidal head, $c = D/4$. Half the volume of a spheroid (the head) is:

$$V = \frac{1}{2} \times \frac{4}{3}\, abc\, \pi$$

Substituting for a, b, and c:

$$V = \frac{1}{2} \times \frac{D}{2} \times \frac{D}{2} \times \frac{D}{4} \times \frac{4}{3}\, \pi$$

$$V = \frac{\pi D^3}{24}\ \text{cu.ft.}$$

To convert to gallons, multiply by 7.48 gal./cu. ft.:

$$V = \frac{7.48\, \pi\, D^3}{24}$$

Or, factoring through:

$$V = 0.979 D^3 \approx D^3\ \text{gal.} \qquad (4)$$

If you round off 0.979 to 1, it is only necessary to cube the I.D. to find the volume of the head in gallons. The results obtained through the use of this method will be 2.17% higher than the actual volume of the head.

This method cannot be used for standard or ASME flanged-and-dished heads which are flatter than elliptical heads. Nor does it include the volume of any integral straight flange which may be part of the elliptical head.

Control Valve C_v's

If you want a very rough idea of the C_v for a particular control valve, or wish to check the location of the decimal point following a complicated slide-rule computation for C_v, simply divide the flow through the valve in gallons/minute by 5, that is:

$$C_v = \text{gpm.}/5.0 \qquad (5)$$

However, remember that Eq. (5) is extremely approximate and is meant to be used mainly as an easy mental exercise for locating the decimal point following a slide-rule calculation. Even so, this equation applies only to valves with high pressure drops—e.g., control valves and needle valves. It won't work at all for gate valves since it assumes that the term (sp. g./ΔP)$^{\frac{1}{2}}$ in the equation:

$$C_v = \text{gpm.}\ (sp.\ g./\Delta\ P)^{1/2}$$

equals $\frac{1}{2}$. This assumes an average pressure drop of 25 psi., which is much too high for a gate valve.

Pounds to Gallons of Flow

Chemical engineering calculations often require conversion of flow rates in pounds/hour to gallons/minute. You can do this in your head with a high degree of accuracy if the specific gravity of the liquid is unity. For other specific gravities the mental arithmetic probably won't be quite so good.

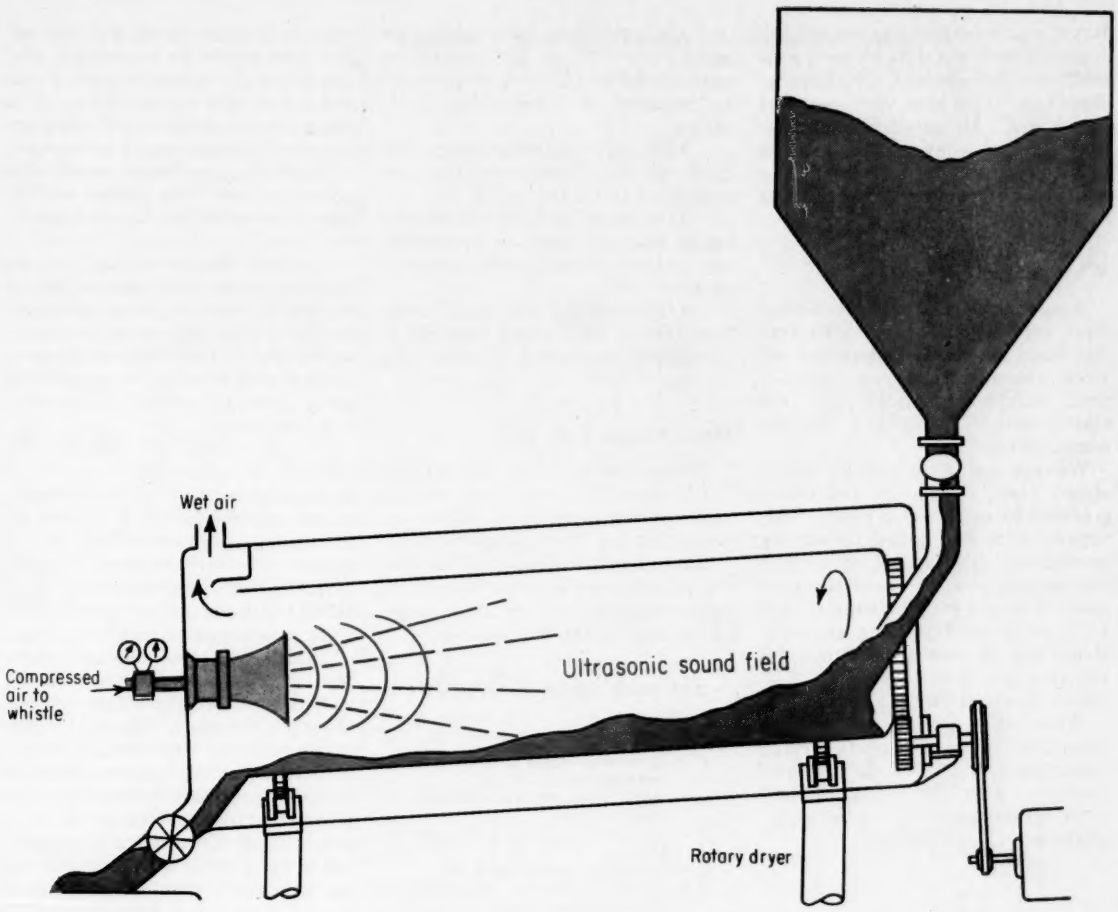
When the gravity is 1.0, simply divide the flow in pounds/hour by 500 to get gallons/minute. The derivation is quite obvious:

$$\frac{1\ \text{lb./hr.}}{60\ \text{min./hr.} \times 8.345\ \text{lb./gal.}} = \frac{1}{500}\ \text{gpm.} \qquad (6)$$

This trick is particularly useful when studying material balances (usually in pounds/hour) and TEMA heat exchanger design sheets, where the cooling water is often specified in pounds/hour. Since chemical engineers are accustomed to discussing liquid flow rates in gallons/minute, a quick conversion method can be useful.

To divide mentally by 500, it is easier to multiply by 2.0 and move the decimal point three places to the left.

If the liquid's specific gravity is not 1.0, then it is necessary to divide the gallons/minute obtained by the formula by the correct specific gravity to get the proper flow rate. The only difficulty here, aside from the mental arithmetic, is in remembering whether to divide or to multiply. A good way to remember is to recall that a given number of pounds will make a smaller number of gallons as the gravity increases. Therefore, if the gravity is greater than unity you want a smaller answer and must divide.



Ultrasonics Boosts Heatless Drying

New equipment and improved techniques are here. Ultrasonics now looks very promising for difficult drying problems, particularly on heat-sensitive materials.

R. M. G. BOUCHER, Senior Research Scientist, New York University

INDUSTRIAL airborne ultrasonics has not lived up to many of the grandiose predictions made for it about 10 yr. ago. At that time a number of "experts" were calling ultrasonics the answer to practically all process problems — a grossly exaggerated claim.

But many chemical engineers have made the mistake of becoming completely disenchanted with acoustics and ignoring the fact that some remarkable progress has been made during the last 10 yr. in design of powerful sound generators and in the application of high-intensity airborne sounds. These developments go a long way towards establishing ultrasonics as a very useful process tool.

It's solved many defoaming and gas cleaning problems. But a new application, now in the pilot-plant stage, has come along — acoustic drying.

Remember, ultrasonics is a relatively expensive form of energy.

But it has a definite place in drying —particularly for difficult materials such as heat-sensitive products or chemicals which have very long drying cycles. An excellent combination involves conventional heating to take out easily removed moisture and ultrasonics to remove the last percentages.

Why Air-Jet Sirens?

Acoustic generators for industrial applications are divided into two main categories: electrical devices (piezoelectric, magnetostriction, electromagnetic) and the static (air-jet whistles), or dynamic sirens.

We are going to discuss static sirens (jets, resonators and horn) powered by compressed gases. This apparatus is well suited for drying operations. It's capable of producing intense, powerful acoustic emissions of over 1 kw., it's rugged with no interior moving parts, it's relatively low in cost and it provides required gas flow turbulence. Efficiency is about 20%.

While still a very young field, laboratory and pilot-plant drying investigations of a wide range of products with an air-jet whistle have established some good rules-of-thumb. These include:

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Author of a number of articles on ultrasonics, Dr. Boucher has written a chapter for the forthcoming McGraw-Hill book "Industrial Ultrasonics."

- Sound intensity level is the main factor governing evaporation rate; a minimum of 145 decibels* is required for industrial processing.
- Thinner material layers dry more rapidly. Maximum thickness suggested is 1-2 in.
- Optimum operative frequency range lies between 6-10 kilocycles/sec. judged on the results obtained to date.
- Intensity of the gas turbulence above the treated material is of utmost importance in industrial drying.

How Sound Can Dry

Theoretical basis of the process is not entirely clarified, but we can give some general ideas which account for the main phenomena.

Rate of evaporation at the boundary of a liquid-gas interface can be approximated, for the first phase of drying, by the Dalton law:

$$v_e = \frac{dm}{dt} = (k)(S)\,\frac{(P - p)}{H}$$

where:

P = Saturation vapor pressure at liquid temperature.
p = Vapor pressure in surrounding atmosphere.
H = Gas pressure of surrounding atmosphere.
S = Surface of treated material.
k = Coefficient strongly dependent on gas turbulence above the interface.

The equation shows that quantity of liquid evaporated per unit of time, is mainly proportional to:

- Gas turbulence above the liquid interface.
- Surface area of the liquid interface and inversely proportional to gas pressure surrounding the liquid boundary.

Creates Violent Surface

If we produce a high-intensity acoustic field just above a liquid surface or above a liquid coated material, we create a very strong turbulence due partly to increased motion of gas molecules and to a regular succession of compressions and expansions which produce violent surface cavitation.

A sound of 160 db. at a frequency of 1 kc./sec. in air corresponds to a velocity amplitude of 628 cm/sec. It is also known by experience, that the effect of expansion always predominates over compression. As a result, moisture is continuously released, either as a liquid or as vapor.

Moreover, the "sonic wind" distribution can also create an increase in coefficient k of Dalton's equation.[6]

Classical vacuum drying is based on decrease of H. When setting up a standing wave system between a generator and the upper level of a liquid or wet material, we create a partial vacuum which is reproduced many times per second at the emission frequency.

If calculating, for instance, the pressure variation amplitude due to acoustic pressure with an intensity of 160 db. we find it is 6% of atmospheric pressure. This is, of course, a relatively low pressure variation, but repeated many thousands times per second, it produces a marked evaporation effect.

Several tests at constant vibration amplitude showed the drying rate is strongly dependent on frequency. Maximum drying is generally between 6 and 10 kc./sec.

Extent of the interface submitted to acoustic radiation is another important factor governing rate of evaporation. Consequently, processing a wet powder with and without mechanical stirring can correspond to a drying time difference of 10 to 1. Engineers must take account of this fact in design of acoustic dryers. The rotary dryer seems, for this reason, one of the most suitable arrangements, since the slow rotary motion involves a continuous renewal of powder interfaces submitted to the sound (see p. 151).

In dealing with porous or fibrous materials, we must also be aware of the role played by external surface S_1 and internal surface S_2 of the processed material. When measuring surface area with a very accurate technique such as the Brunauer, Emmett, Teller method (by gas adsorption at −195 K.) it is possible to determine total value ($S = S_1 + S_2$), taking account of all the area corresponding to internal channels and micropores.

Provide Gas Turbulence

Another fact of great importance is the need for a strong macroturbulence in the gas layer surrounding any treated material. Ul-

*Decibel is a unit of sound intensity. Frequency is expressed in cycles/sec. Ultrasonics is considered in the 20,000 cycles/sec. and above range, but many industrial applications of "ultrasonics" involve sound in the sonic range.

trasonic waves often provide enough energy to expel water molecules from the interface but not enough turbulence to carry moisture away rapidly. This explains why a partial vacuum or a strong draft of air is a must for successful results.

Incidentally, we have seen comparative tests on a number of materials subjected to air-jet acoustic drying and to air flow only from the generator (whistle with and without resonator). Air serves to carry water vapor away but it alone is incapable of reducing relative humidity more than a few percent.

Pilot-Plant Tests

We now intend to review some published results and to describe a series of recent laboratory and pilot-plant experiments.[7]

Fig. 1 shows a typical set-up used by the majority of scientists experimenting in this field. On the left note the arrangement corresponding to the direct method (sonic irradiation and draft of air). On the right is the set-up for treatment through a sound permeable membrane with a partial vacuum system in the lower compartment, to avoid oxidation of material.

P. Greguss[3] was first to apply acoustics to an industrial drying problem. This involved raw cotton (Ultrasonic drying was first considered in two U. S. patents[1, 2]).

A short time after Greguss's work, R. M. G. Boucher processed materials as different as colloidal zirconium hydroxide, carboxy methyl cellulose, and titanium dioxide milk, using the same technique. In 1957, J. Palme[4] mentioned that the drying time of fresh wood could be reduced from 3 weeks to 5 min. when applying a proper airborne sound field. The same year J. Moinet[5] in France successfully processed photographic films and fruits in the laboratory.

In the Greguss experiments, a strip of wet cotton moved (10 in./min.) under an intense ultrasonic beam produced by a rotary siren fitted with a parabolic horn and emitting in the range of 20 to 25 kc./sec. Distance from the siren to the material treated was 1 ft. and contact time in the acoustic field was 3 min. Siren air consumption was in the neighborhood of 106 cfm. Intensity at the surface of the processed cotton: 140-150 db. Moist air was sucked away by means of an exhaust system operating underneath the cotton conveyor. Greguss claimed that he was able to eliminate 30% of moisture.

Reproducing this experiment with a Multiwhistle RB[7, 8, 9, 10] fitted with two whistles (8 kc./sec., 60-70 cfm. air, 67.5 psi.) we observed that eliminating 50% of adsorbed water requires 10 min. for a sample containing 600% water by weight and only 5 min. for 300%. The last figure is in good agreement with the Greguss data for 3 min. irradiation.

Dry Without Heat

We have dried a highly heat-sensitive hormone in 20 min. where normal processing requires more than 1 hr. This hormone was dried

Typical Pilot-Plant Setups for Acoustic Drying

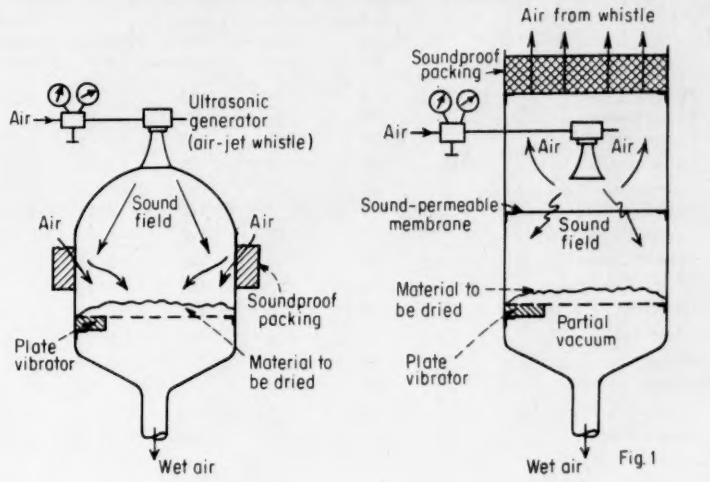

Fig. 1

Ultrasonic Drying: Fast Way to Desorb Silica Gel

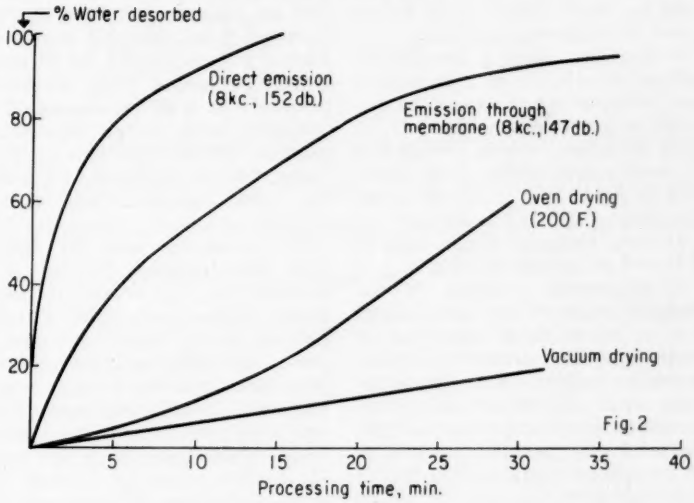

Fig. 2

Drying Tests Show Value of Acoustic Drying

	Humidity or Solvent Content, %	Time for Complete Drying, Min.	Intensity in Decibels	Frequency, Kc.	Material Thickness, In.
Paper mache	170	79	149	10–15	0.2
Paper mache	170	250	142	33	0.2
Paper mache	170	270	140	45	0.2
Cellophane	40	5	149	10–15	0.05
Impregnated crepe paper	80	5	142	45	0.05
Rubber pellets	6	2½	149	10–15	0.8
Rubber pellets	6	12	140	45	0.8
Asbestos brick	10	130	149	10–15	2
Wood fiber board	10	20	149	10–15	1
Sheet rock	45	16	149	10–15	0.3
Sheet rock	22	6	149	10–15	0.5
Rubber mat	50	8	142	10–15	0.025
Rubber mat	50	25	142	33	0.025
Fermentation sediment	108	14	138	8–10	0.25
Raw cotton	300	14	140	8–10	0.5

with the partial vacuum technique, the sound transmitted through a 0.002-in. thick Pliofilm membrane placed 8 in. above the sample.

With the direct irradiation method, we also dried a fermentation sediment which cannot be exposed to temperatures above 40 C. With an intensity level of 138-140 db., to evaporate 50% of the moisture at 33 kc./sec. required twice the time (12 min.) necessary at 8 kc./sec. Original water content of the 20 gr. sample was 118%.

A widespread problem in the chemical industry involves desorption of water from silica gel or other types of adsorbents (alumina, activated carbon, etc.) To determine what advantages can be expected from an ultrasonic method, we tried this technique with a 40 gr. sample of Davison silica gel.

A glance at the curves of Fig. 2 confirms the preceding observations. When using a Monowhistle (whistle V_1, 67.5 psi. at the nozzle, free air consumption 30 cfm., frequency 6.8 kc., acoustic power 60 watts) we evaporated, in 15 min., all water adsorbed (25% physically bounded) on a 40 gr. sample. The intensity level during processing reached 152 db. Through a membrane, with an intensity of 145 db., the same operation was accomplished in 45 min.

These results are far better than that achieved through conventional heating or vacuum processes. Le Landais in Sweden[11] mentioned a drying time of 130 min. to obtain complete moisture elimination when treating a sample containing 77% adsorbed water. This refers to processing without membrane when using a Monowhistle identical to ours. Le Landais also stressed that low frequencies of 6-8 kc./sec. give two or three times better results than emission in the range of 32 and 45 kc./sec.

How Ultrasonics Change Size Distribution in Spray Drying

Screen Mesh	—Sieve Analysis of Product— Without Ultrasonics	With Ultrasonics
25	0 5%	0.6%
40	1.9	9 0
60	31.9	49 8
100	60.7	39.6
On pan	5.7	1.0

Dry Asbestos Paper

In another series of drying tests we treated asbestos paper (0.27-in. thick) and fiberglass surfacing mats (0.01-in. thick). These thin materials were exposed to a sound beam emitted by a Monowhistle RB with an exponential horn at a 10 in. distance from the whistle.

We discovered best results were achieved again at low frequency (6-8 kc./sec.). The fiberglass sheet containing 50% water was completely dried in 2½ min. Thicker asbestos paper needed more than 4 min. (intensities 140-144 db.).

The table gives additional data obtained with direct irradiation.

We should also mention some phenomena observed in a spray dryer (air flow 5,000 cfm.) using an ultrasonic emission of 10-15 kc./sec.

Spray dryers appear to be an ideal situation for ultrasonics—fine atomized wet globules can be held longer in suspension by an acoustic field. When the particles are vibrated, their surface is exposed to more drying air.

Another factor to consider is some agglomeration occurs between smaller sprayed globules with a large oscillation amplitude and larger globules with a small oscillation amplitude. This leads to higher recovery rates and to a definite change in the size distribution of the product collected at the bottom of the dryer (see table).

Promising Future

In summing up, we can say that use of airborne ultrasonics is now well worth the attention of chemical engineers. We predict a tremendous growth for ultrasonics in treatment of heat-sensitive materials, particularly in the pharmaceutical, food and chemical fields.

Based on a paper given at the Third International Congress on Acoustics in Stuttgart, Germany, Sept. 2, 1959.
Note: the two tables shown in the article are courtesy of Gulton Industries.

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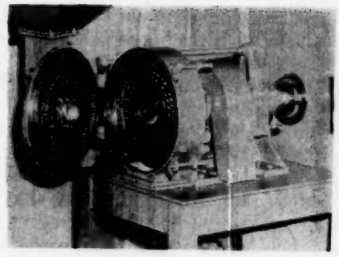

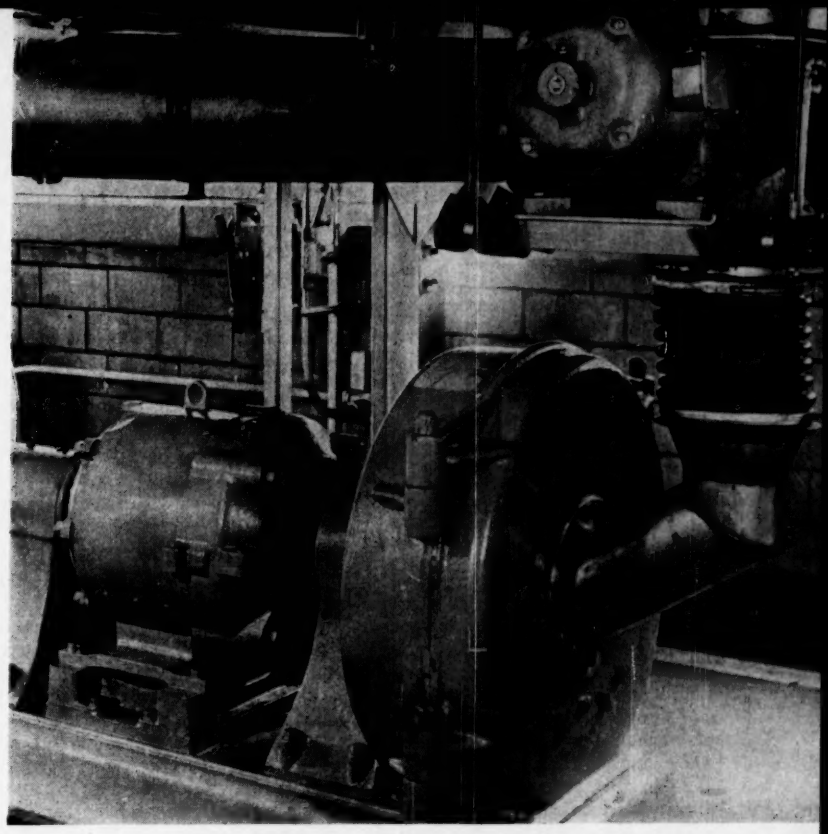

LARGE MODEL single-runner attrition mill on the right, used at Eastman Kodak for shredding chemicals, was scaled-up from the pilot model above.

Scale-Up for Solids Processing

Here are a series of case studies to show you why the scaling-up of solids-processing equipment is different and difficult and how to go about solving some of the problems.

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As a chemical engineer, chances are your laboratory work in school was confined to the conventional subjects of fluid flow, heat transfer, distillation and perhaps humidification and filtration. In your studies you may have rushed over some data on the mixing of solids and size reduction.

If you had an exceptionally well-equipped unit operations laboratory you might have had one small reduction unit or perhaps a mixer in an isolated corner of the lab. Time permitting, at the end of the semester you witnessed or participated in a brief test.

However, for most of us with chemical engineering training, the problems of size reduction, mixing, materials handling and pelleting along with sifting, were barely touched. It is to these areas that I would like to confine my remarks.

More conventional unit operations, such as fluid flow or heat transfer, are characterized by theoretical formulas that permit the process engineer to calculate theoretical size and scale-up laboratory equipment with considerable accuracy.

This isn't the case when processing dry materials.

Naturally, you'll find a few isolated relationships, but they are of limited value.

Therefore, the engineer ends up by multiplying the theoretical results by some safety factor because of his great doubt in the validity of the original formula.

If the equipment is changed in any respect, his carefully determined factors are immediately void and the engineer must start from the beginning. Net result is that recognizing this limitation on theory, you must go into a lab with prototype equipment.

As a result, the unit operations involving dry materials have developed into arts and have generally minimized the theoretical approach.

There are obviously many factors you must take into consideration in scaling up laboratory equipment to production size units. Some of these factors include hp., speed, screen area, etc. To understand these, it's perhaps best to discuss a number of actual scale-up problems.

Find the Key Factor

Let us consider first, the scale-up of a rotary knife cutter with a 10-in. dia. rotor, 18-in. long. This unit is used to cut alpha pulp on a commercial scale. The big question: how to scale-up this unit to a large size cutter.

For Successful Scale-Up, Remember . . .

- **Try to find the key factor—at times hp. predominates, other times, it might be speed or screen area.**
- **Straight-line relationships don't always exist.**
- **Sometimes, you need long-range tests.**
- **Lab tests are only guides.**

In the lab unit, the knife cutter consists of a rotor on which are mounted five knives, equally spaced. The rotor operates within a circle of five stationary knives, thereby achieving 25 cuts/rev. of the rotor.

Approximately three-quarters of the circumference of this rotor is enclosed by a screen. Size of the hole in this screen determines the top particle size. If we keep the screen size—that is, the hole diameter—consistent in the scale-up, one variable is automatically eliminated from the picture.

You can readily see, any unit in which the cutting chamber is enclosed by a relatively small opening screen has a volumetric limitation on capacity. What factors, then, are involved in limiting this cutting chamber volume?

Of course, we know the length of the cutter and the circumferencial screen area: the rotor of the small cutter is 18-in. long and 10-in. dia. In the large cutter, the rotor is 30-in. long and 20-in. dia. Actual ratio of screen area of the large cutter to the small cutter is approximately 3.12.

But, is the screen area the only determining factor? In the small cutter we have five stationary knives with 25 cuts/rev. In the large cutter there are 12 knives on the rotor giving us 60 cuts/rev.

Also, there's a 20-in. dia. rotor in the large cutter. Using the same approximate rotor speed, we therefore have a much higher peripheral speed in the larger cutter, and hence, a greater impact action on the product.

In addition to the factors mentioned above, take into consideration the number of cuts/rev. and the speed of the unit. This gives us the number of cuts/min. Also consider length of the knives. Doing this, we can start talking about the number of in.-cuts/min.

Linking all of these factors together we have a ratio of approximately 4 to 1 in.-cuts/min. for the big cutter as compared with the laboratory unit.

This cutter is also designed with certain limitations on the maximum applied hp. Maximum allowable hp. on the small cutter is 25 whereas we can put 75 to 100 hp. on the big unit.

Remember, this cutter is a unit limited by volumetric requirements, and therefore we must not attempt to prorate our capacity beyond the theoretical capacity of the screens.

Therefore, we have four variables under consideration. Screen area, peripheral speed, cuts/rev. and hp.

Which of these factors is the most influential? Experience shows that the number of in.-cuts/min. is the most critical one, provided scale-up falls within the volumetric limitations of the unit. In that range, this unit has a scale-up factor of approximately 3 to 1.

For example, pulp is handled on the smaller unit at a rate of approximately 300 lb./hr. With a large unit we have achieved the capacity of 900 to 1,000 lb./hr. With extremely fine screens, this scale-up factor may be reduced, but the principle is the same.

Sometimes Hp. Predominates

Continuing with this knife cutter example, we find that there are many applications where hp. is the predominating factor. I am thinking primarily of applications where shock loading is encountered or extremely tough materials such as plastic or rubber are being cut. Here, greater than average power requirements are demanded.

In these cases, we often find the hp. required exceeds design limitations of the smaller units even though the volumetric requirement is relatively low and normally handled on smaller unit. Sometimes we compensate in part by specifying a stronger material of construction, and therefore raise the design limitations of the smaller unit.

However, there are still many applications where we need the larger machine with its bigger shafts, diameter, bearings, etc.

To illustrate a scale-up problem involving hp., let's look at the shredding of alkali cellulose in an attrition mill. Here we are scaling up from a laboratory unit with a 24-in. dia. disk to a 30-in. dia. disk. Scale-up factor in this particular instance is a straight-line function based on the hp.

Operating principle of this machine consists of a rotating disk operating against a stationary disk. Cast plates of various designs are mounted on each of the disks. Clearance between the rotating and the stationary member is adjustable with a handwheel mechanism. Product enters the mill at the center of the stationary disk and works its way radially to the periphery of the runner head where it is discharged tangentially.

Preliminary laboratory work on this mill was done with a 25-hp. motor, with the plates set approximately one-half a turn open. This is equivalent to 0.042-in. clearance between the plates.

Under these operations, alkali cellulose is shredded at a rate of 38 lb./min., using only 15 hp. Stated another way, the rate is 151 lb./hp.-hr.

Scaled up to production size, the larger mill's estimated capacity is approximately 8,100 lb./hr. when equipped with a 60 hp. motor.

After installing this unit, field observations revealed this mill delivered, at the same setting, approximately 8,000 to 9,000 lb./hr. or 140 to 150 lb./hp.-hr. Compared with the 151 lb./hp.-hr. obtained on the small mill, it's obvious a straight-line relationship exists between the two mills and that hp. is the influencing factor.

Not Always a Direct Relationship

Another interesting application involving attrition mills is a slurry processing problem with a phase

change. Here, the objective was to reduce a filter cake containing 25% solids and 75% water, weighing 70 lb./cu. ft. to a pumpable slurry having the consistency of white, table cream. This material exhibited thixotropic properties.

Laboratory tests on a 12-in. mill equipped with a 7.5-hp. motor, were run at 2,500 rpm. With this unit, using 5 hp., capacity was approximately 3,000 lb./hr., or 600 lb./hp.-hr.

Scale-up to the commercial unit involved a 36-in. unit with a 50-hp. motor. With this unit, capacity was estimated at 10 tons/hr. This gives a throughput rate of approximately 400 lb./hp.-hr., or a slight decrease in rate when compared to the laboratory unit.

Significant factor here is that the straight-line formula with hp. as the influencing factor doesn't apply.

An interesting sidelight on the slurry processing test was an extreme vibration that occurred upon continuous running of this material. This further illustrates the pitfalls encountered with some materials on short-duration laboratory runs.

It seems, slurry worked its way behind the plates and built up on the surfaces of the runner head. This problem was solved by filling in the backs of the plates with plastic and thus eliminating the voids.

Of course, since this is a high-speed unit, it was necessary to carefully balance the plates so as not to cause a vibration by the use of the plastic.

Volume Enters Too

Here, in another attrition mill application, volume is the determining factor. The problem is to shred alpha pulp from a 30-in. sheet into a fluffy, cotton-like mass at a rate of 2,000 lb./hr.

Tests were run on a 12-in. laboratory mill at 300 lb./hr. using less than 4 hp. From the data collected, the solution to scale-up was a 36-in. mill with a special feeder.

This feeder consists of a forming cone in which the sheet pulp is twisted and then fed into the eye of the mill with a pair of variable-speed, feed rolls.

In the scaled-up unit, capacity requirements of 1 ton/hr. were met with less than 30 hp.

Now, neither the hp. nor the capacity dictated selecting a 36-in. mill. Let's look into this a little further.

We started with a 30-in. wide sheet and folded it into a double section with the pulp feeder. This large 36-in. mill has an inlet dia. of 16.5 in. while the next smaller size has an opening of only 10.5 in. Obviously, if we used the smaller mill it's necessary to fold the stock more than twice.

Further complications come from the product density. After shredding, this is less than 1 lb./cu. ft. The 36-in. mill has an oversize shell that permits the light density stock to flow freely.

Knowing the System Helps

Now let's turn to another type of unit that permits checking still another factor in scale-up.

In this case, we are asked to grind pepper berries to the granulated product used on the dining room table.

For such a reduction, a roller mill is specified. Grinding is done by passing the pepper berries between two parallel iron cylinders that have been cut with carefully predetermined corrugations on the surface.

Preliminary tests were on an 18-in. long unit in the laboratory and product was handled at 100 lb./hr. for every in. of length of machine. In actual practice, the unit was scaled up to a 42-in. wide machine delivering a product at 3,000 lb./hr.

Notice: this is a reduction of capacity from the 100 lb./hr.-in. to approximately 71 lb./hr.-in. You might logically ask: why this reduction?

There are certain peculiarities about the pepper berry that necessitate tempering the capacity estimate.

These small, hard berries are extremely abrasive and in a short time the sharp corrugations of the roll become worn. As this dulling action occurs the ability to grind is accordingly reduced.

In addition, as the rolls become less sharp there is a tendency to create additional fines or objectionally dusty material. This is particularly true when the mill is operated at high capacities.

Moreover, the high temperature involved with high throughputs, causes a loss of the volatile oils from the pepper and reduces the flavor.

Therefore, to compensate for the dulling action and its accompanyside effects, the estimated throughput is reduced to 71 lb./hr.-in.

In view of experience on at least five commercial installations, this reduction is justified and the unit will operate successfully over a period of many months with a consistent throughput of product.

This application of pepper grinding typifies scale-up of an entire processing system rather than just a single-unit machine.

Although tests were run on a single pair of rolls, in actual practice a double pair of rolls is used.

Pepper berries are fed into one side of the mill from a surge bin. Product of the mill is taken by means of screw conveyor and bucket elevator to a sifter on the floor above. This sifter separates the desirable pepper from the coarse or oversize and from the dust. Desirable products are then taken by means of a screw conveyor to packaging equipment. Oversized material from the sifter is conveyed to the second pair of rolls and given additional grinding to bring it to the desired particle size.

All units were scaled up to the size necessary to handle the 42-in. wide roller mill. Failure of any one of these units to adequately handle the required capacity means the failure of the system as a whole.

For Success, Consider All Factors

Now, scale-up isn't always accurate, even with laboratory help. One or two examples of inaccuracies or errors will illustrate some additional factors of importance.

Take the problem of mixing a hormone with a vehicle of dried corn distiller's solubles. This type of mixing is done on a vertical unit.

Here, we have a cylindrical tank with a hoppered bottom. A screw operating in the center of the mixer elevates the material to the top of the unit where it cascades outward and flows by gravity to a conical section. Then, it is again picked up by the screw and recirculated. Hence, the mixing action depends upon a complete series of turnovers of the material and unit.

Preliminary tests conducted on a 10 cu. ft. unit showed the factors involved in scale-up are the size of the screw itself, the speed of the screw and the ratio of mixer-tank dia. to screw dia.

Laboratory tests showed good mixing in 7.5 min. with no appreciable improvement thereafter. Calculations showed that this 7.5 min. mixing time meant approximately 12 complete turnovers of material.

Scaled-up unit was to have a 100 cu. ft. volumetric capacity.

Taking this same theoretical 12 turnovers to achieve complete mixing, we should expect a mixing time of approximately 15 min. in the big unit. Actual practice, however, showed no improvement in the quality of the mixer after 5 min.

How do we explain this inconsistency? Careful inspection of the two units showed the commercial unit had a baffle in the top of the mixer permitting a more uniform dispersion of material across the entire dia. of the mixer when it was discharged from the screw. The laboratory unit did not have this feature.

It can therefore be rationalized that the baffle was an attributing factor not taken into consideration on the original scale-up.

The second mixer application illustrates another unsuccessful case of scale-up.

In this instance, a horizontal batch mixer with a ribbon-type agitator was meant to handle a 3,000-lb. batch of material. The mixer itself had a capacity of 58 cu. ft. and was more than adequate to take the required batch size.

Actual problem was to mix soda ash with a liquid detergent.

Based upon experience with a similar material with the same bulk density and the small laboratory mixer, theoretical hp. for the 3,000-lb. batch was calculated at 20. However, in actual practice, the 20-hp. motor was overloaded by at least 30% when the mixer itself was only half full.

In looking for the reason behind this it was discovered that the liquid detergent provided the dry material with different mixing characteristics. By this, we mean there was an appreciable difference in the resistance of individual particles to slide upon themselves, and thus power requirements were significantly higher.

While the unit itself had adequate volumetric capacity, the motor, roller chain drive, bearings and agitator weren't designed to accomodate the required hp.

Extended Tests Are Needed

Very often, scale-up is in itself successful but different factors enter the picture nullifying the accuracy of the laboratory work or even nullifying the application itself.

For example, in the past, inorganic salts have been successfully pelleted in the laboratory. Particular problem here was to densify a nitrite in order to get more of it into a given package for overseas shipment.

Laboratory work appeared successful enough to justify purchase and installation of a mill.

Although the mill produced pellets at desired capacity and of acceptable quality, nothing but grief resulted because of continued die failure.

Due to the characteristics of the material, die failure occurred every two or three weeks. This was due to actual breakage of the die under the conditions of operations. Subsequent research proved that this could be substantially reduced if a special die were furnished of a high-grade steel.

It does serve to point up, however, some one of the factors that you can't determine on a short-scale laboratory test. Other factors are corrosion or abrasion. You may get an indication on the short-run test, but usually you can't predict the degree or extent of these factors.

A particularly interesting scale-up problem is a case concerned with classifying activated carbon and lignite into various cuts.

Tests showed that to handle 1,000 lb./hr., a specific size sifter was required. However, in order to handle six times that amount, or 6,000 lb./hr., a sifter with only 3.5 times as much bolting area was required.

In other words, in this case you can handle six times as much capacity on a unit having only 3.5 times the screen area. On the surface this appears impossible.

To explain this means that you must better understand the method of calculating sifter capacities. There ar actually three variables going into the selection of a given screen size: ultimate required capacity, linear rate the material travels across the screen and stock depth on the screen.

These variables are related in a parabolic function rather than a straight line function. In other words, as the capacity increases the curve shows a decreasing slope and in time almost levels out to a horizontal line.

It's particularly important to know the ultimate capacity requirements before starting laboratory tests. By knowing the ultimate capacity you can preselect the stock depth from predetermined curves for that particular screen.

Sifting is one unit operation that more than any other illustrates the frequent need for continuous tests as opposed to short-run or limited tests. This is particularly true when you run into materials that show any tendency to blind the screen or develop static electricity.

In general, these items don't show up with a few pounds of test material, but begin to evidence themselves after continuous running of 15 to 30 min.

Lab Tests Are Only Guides

The above tests illustrate only a few of the problems encountered in scale-up from a laboratory unit to the production machine.

The basic thing to remember is that laboratory tests are valuable guides but in dealing with solids and slurries, you must never underestimate the importance of experience.

K. R. STERRETT, in a way of speaking, has lived with the problems of lab tests and scale-up of solids processing equipment. Since joining Sprout, Waldron, he has held a variety of posts and is currently Chief Chemical Engineer and Special Engineering Assistant to the Vice President. Ken holds a B.S. in Ch. E. from Penn State and has a number of mechanical engineering courses under his belt.

From 4 sets of empirical data . . .

Chart Predicts Evaporation Rates

New chart helps designers find rate of evaporation for any fluid in a moving air stream, circumvents difficult, complex, often insolvable multiple-variable calculations.

AARON FEDER, Senior Development Engineer, The Marquardt Corp., Van Nuys, California

ARE YOU designing a jet engine, spray dryer or cooling tower? Are you concerned in any way with the evaporation of liquids into an air stream? If you are, then you can make good use of a chart which will give you the evaporation rate for any liquid dispersed in a moving air stream.

Equipment such as jet engine combustors, spray dryers and cooling towers depends upon the evaporation of a liquid in a moving air stream to perform its various functions. The design of such equipment requires some knowledge of liquid evaporation rates under the conditions encountered. In jet engines, for example, the fuel is frequently injected as liquid droplets at a point upstream of the combustion zone. The concentration of vaporized fuel in the fuel-air stream entering this zone is determined by the rate of evaporation of the droplets. Spray dryers operate through much the same mechanism. Cooling towers vary considerably in their design, but also depend in large measure on the evaporation of water in a moving air stream for their cooling effect.

Depending on the type of equipment, the liquid may evaporate from spheres (droplets), cylinders (chamber walls or drums), or flat surfaces (cooling tower slats). All of these forms of evaporation may take place in the same piece of equipment.

Two parameters are important in describing liquid vaporization: (1) The equilibrium vaporization rate which sets the upper limit on the extent of vaporization and (2) the actual vaporization rate in the equipment. Either of these quantities is difficult to calculate with any accuracy. The interrelation of the variables affecting vaporization cannot be analytically established. Further, accurate data on the physical characteristics of liquid and vapor fractions, the size distribution of the drops, and the details of the flow of surrounding gas past the drop, are seldom available. Even if these data were available, solution of the necessary equations, as outlined by Longwell,[1] would be extremely laborious.

For this reason, empirical knowledge is necessary.

The empirical data of Longwell and Weiss[2] show that the fraction f of liquid evaporated in a moving air stream is primarily a function of the liquid "stay time" t (which is the distance the liquid drops travel in the moving air stream, divided by the air velocity); the boiling point of the liquid T_{bp}; the absolute pressure of the air-liquid mixture P; the air velocity V; the air static temperature T; and the droplet size d.

Unfortunately, experimental data exist only over a limited range of any of these operating variables. Here we have extended this range by determining the effect of changes in each of the variables on the vaporization rates.

On the next page is a "go-around" chart, somewhat similar to the charts used for determining radiant heat transfer in the author's recent article on that subject (*Chem. Eng.*, pp. 101-4, Jan. 26, 1959). The chart consists of four parts, one in each of the four quadrants, which permit an estimate to be made of the fraction of liquid which will be evaporated into an air stream.

The chart is based on empirical relationships* between droplet diameter, liquid stay time and fraction of liquid evaporated, plus the four operating variables of liquid boiling point, air velocity, air static pressure and air static temperature. Each quadrant of the chart holds all of these factors constant, except for one of the four operating variables. These are varied one at a time. Knowing the values of the operating variables, the reader can easily calculate the equilibrium value of the vaporization rate for those conditions.

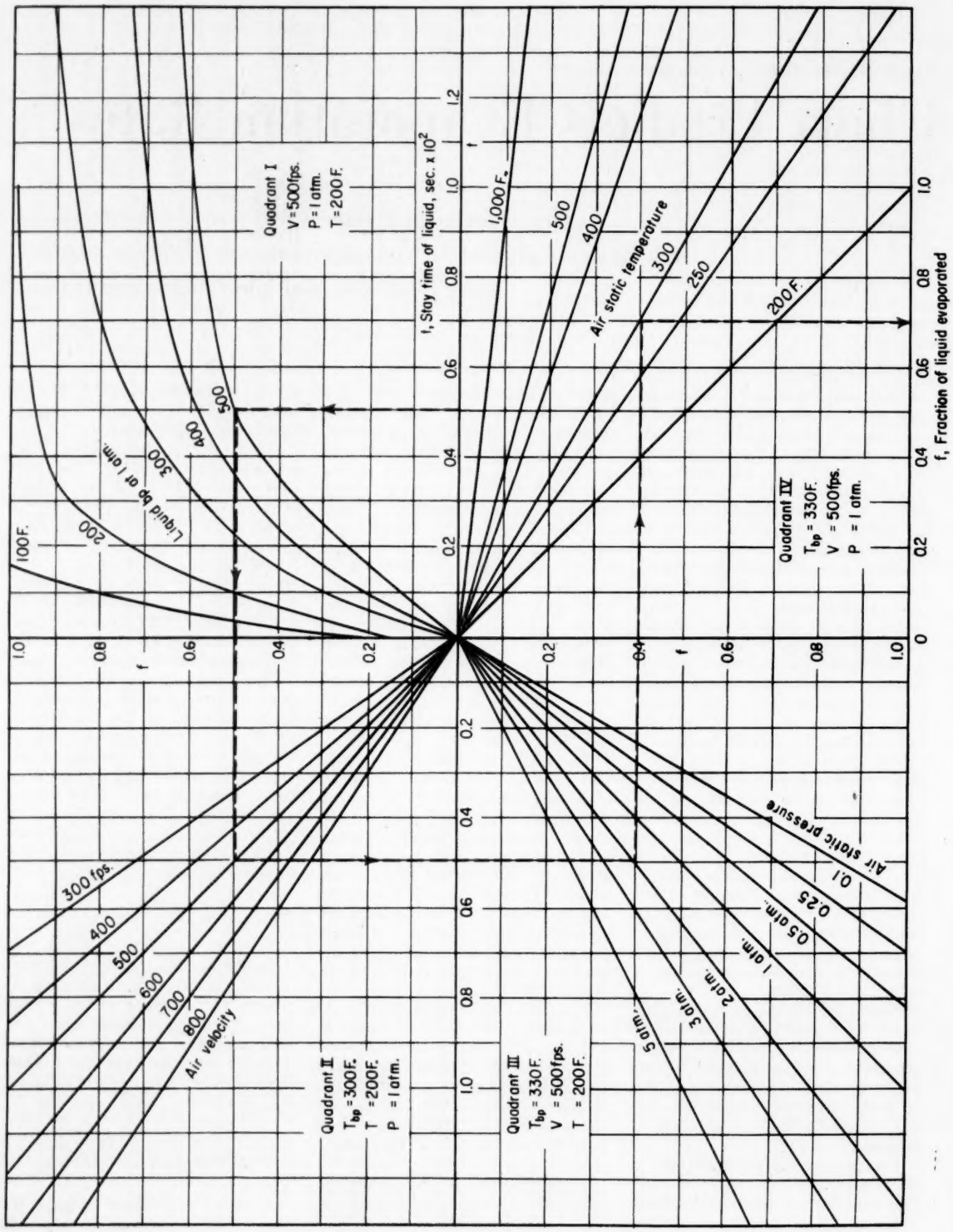
How Chart Was Made

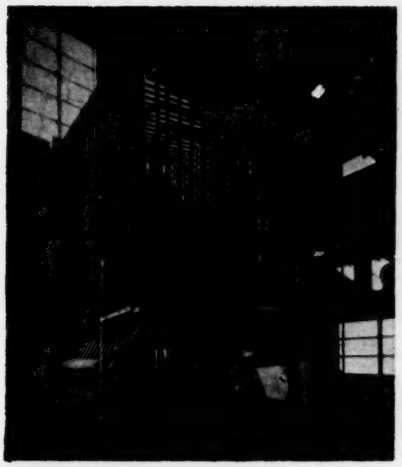
Boiling Point Effect—Ref. (1) gives empirical data on the extent of fuel evaporation in a moving air stream as a function of liquid stay time. The fuels included are naphtha, kerosene and a fuel called Solvesso 100. For the three fuels the test conditions are respectively: T_{bp} = 136 F., 328 F. and 428 F.; P = 1 atm. for all; V = 500 fps. for all; T = 200 F. for all. With cross-stream injection from a sin-

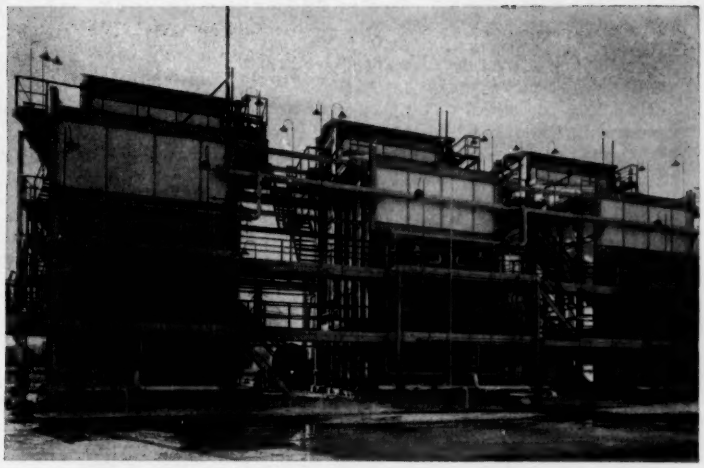
* A complete description of the theory and assumptions used in constructing the chart may be obtained from the author on request. Address him c/o The Marquardt Corp., 16,555 Saticoy St., Van Nuys, Calif.

Chart on page 160
Text continues on page 162

Chart Predicts Evaporation Rates







AT LEFT: Installing a 60,000 lbs/hr unit in a brewery

ABOVE: A battery of 125,000 lbs/hr units in a chemical plant

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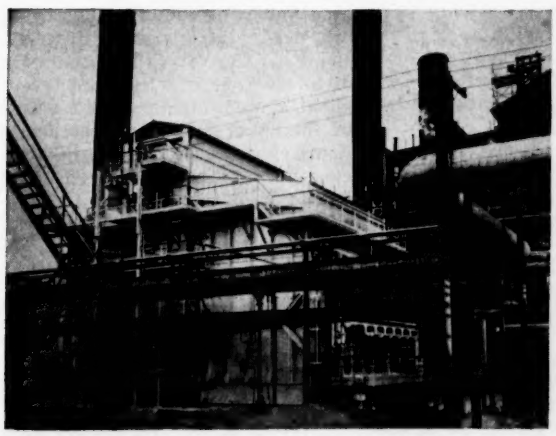
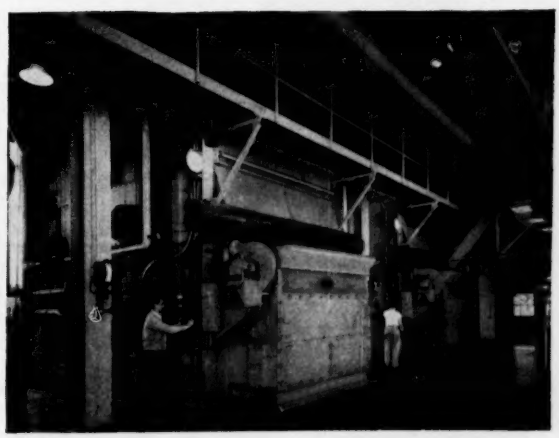


This 400,000 lbs/hr unit is installed in a leading petroleum refinery



Three 40,000 lbs/hr units serve a medical center

gle orifice, the average droplet diameter is about 45 microns.

The data on boiling point effect are used in Quadrant I of the chart. Interpolation of these data enables the plot to give the fraction f of liquid evaporated as a function of liquid stay time for boiling points ranging from 100 F. to 500 F. Note that the values of $V = 500$ fps., $P = 1$ atm. and $T = 200$ F. remain constant in Quadrant I.

Velocity Effect—Data in Ref. (2) provide information on the effect of air velocity on the fraction of liquid evaporated in an air stream for air velocities from 300 to 800 fps.

The section of the chart in Quadrant II covers variable air velocity, with liquid boiling point, air static temperature and air static pressure held constant at 330 F., 200 F. and 1 atm., respectively.

Pressure Effect—Ref. (3) provides information on the effect of system pressure on the vaporization rate of liquid droplets in an air stream. The effect depends directly on the effect of pressure on the surface temperature of a drop. Refs. (3) and (4) give information on various liquids, showing the variation of the difference between air temperature and drop surface temperature as a function of the static pressure of the air for a single drop.

The next chart section, Quadrant III, has been constructed to introduce the effect of static pressure. It has been drawn as a plot of fraction of liquid evaporated for mixture pressures ranging from 0.1 to 5.0 atm. The constant values include air temperature, 200 F., air velocity, 500 fps. and liquid boiling point, 330 F.

Air Temperature Effect — The section of the chart designated as Quadrant IV takes account of the effect of air temperature on the vaporization rate from a single drop. Ref. (3) gives data used in its construction. The chart covers air static temperatures from 200 to 1,000 F. Held constant for this section are: liquid boiling point, 330 F., air velocity, 500 fps. and mixture pressure, 1 atm.

Nomenclature

d	Average droplet diameter, microns.
f	Fraction of liquid evaporated in time t.
P	Air static pressure, psia.
t	Liquid stay time, i.e., time available for evaporation of liquid droplet = distance X traveled/air velocity V.
T	Air static temperature, °F.
T_{b_p}	Boiling point of liquid at 1 atm., °F.
V	Air velocity, fps.
X	Distance droplets travel downstream from injection point during which evaporation can take place, ft.

How to Use the Chart

To use the chart in estimating the fraction of the liquid that will be evaporated in a moving air stream, the following variables must be known:

- Stay time of the liquid.
- Liquid boiling point at 1 atm.
- Air velocity.
- Air static pressure.
- Air static temperature.

Calculate the stay time by dividing the distance X through which the drops move in the air stream by the air velocity. Enter the chart in Quadrant I at this stay time. Proceed upward to the liquid boiling point, then horizontally into Quadrant II to the air velocity. Move vertically downward to Quadrant III at the air static pressure, then horizontally to Quadrant IV at the air static temperature. The final move is downward to the fraction f of liquid evaporated.

Take an Example

The lines on the chart show the solution where stay time is 0.005 sec., liquid boiling point is 500 F., air velocity is 500 fps., air static pressure is 2 atm. and air static temperature is 300 F. The fraction of liquid evaporated is found to be 0.7.

Accuracy and Limitations

You will notice that the chart has been drawn for the following:

• Stay time	0-0.01 sec.
• Liquid bp.	100-500 F.
• Air velocity	300-800 fps.
• Air temperature	200-1,000 F.
• Air pressure	0.1-5 atm.

In plotting for these ranges it was necessary to extrapolate some of the data in Refs. (1) to (4) to higher values of the parameters.

Another point to be considered is that the chart is based on equilibrium vaporization and hence the results given will be limiting conditions. Although equilibrium vaporization will ordinarily not be obtained in normal industrial and jet engine evaporation processes, the degree to which the actual evaporation will approach this limiting condition will be influenced by such factors as good liquid atomization and the attainment of a relatively long liquid stay time.

In summary, the chart presented here is intended to supplant the very laborious calculations that would be needed—if data were available—in designing for problems involving liquid evaporation into moving air streams. Based on empirical data and the assumption of an average droplet diameter of about 45 microns, the four sections of the chart determine fraction of liquid evaporated under equilibrium conditions as a function of liquid boiling point, air velocity, air pressure and air temperature.

AARON FEDER was born in Przemyszl, Poland, but came to the United States in 1939, prior to World War II. He received his Bachelor's degree in chemical engineering from the University of California and now specializes in thermodynamics as a senior development engineer with the Marquardt Corp., Van Nuys, Calif. Mr. Feder is a member of the American Rocket Society and the Combustion Institute.

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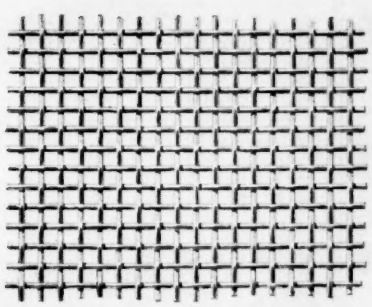
3. Ingebo, R. D., "Pressure Effects of Vaporization Rate," NACA TN 2850 (1953).
4. Ingebo, R. D., "Vaporization Rates and Heat Transfer Coefficients for Pure Liquid Drops," NACA TN 2368 (1951).

whatever you make in stainless steel wire



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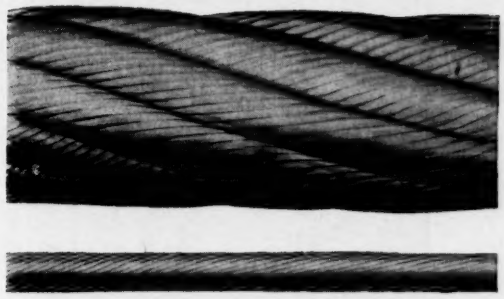

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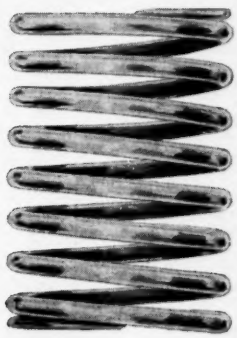
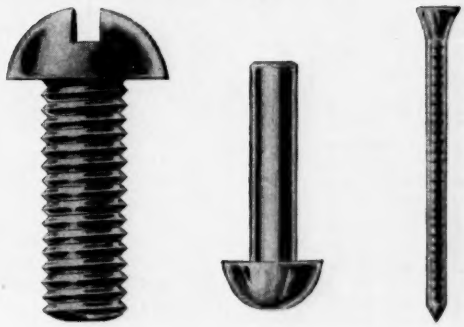


cold-headings



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Charles A. Adams, Sr. Chemical Engineer, Kaiser Aluminum & Chemical Corp., Gramercy, La.

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Motor Hp ▶	3	5	7.5	10	15	20	25	30	50
Materials									
Motor	$160	$225	$300	$320	$450	$560	$675	$840	$1,350
Motor control	345	345	345	420	420	420	420	540	540
Conduit & wire (per 100 ft)	85	85	85	130	130	130	130	170	170
Total materials costs	**590**	**655**	**730**	**870**	**1,000**	**1,110**	**1,225**	**1,550**	**2,060**
Labor									
Motor & motor control	$90	$90	$90	$120	$120	$120	$120	$190	$190
Conduit & wiring (per 100 ft)	210	210	210	300	300	300	300	435	435
Total labor costs	**300**	**300**	**300**	**420**	**420**	**420**	**420**	**625**	**625**
Total costs	**$890**	**$955**	**$1,030**	**$1,290**	**$1,420**	**$1,530**	**$1,645**	**$2,175**	**$2,685**

Notes:
1. Costs of foundations, handling and miscellaneous mechanical work are not included.
2. Motor control centers costs are estimated at $1,100 material plus $200 labor per panel.

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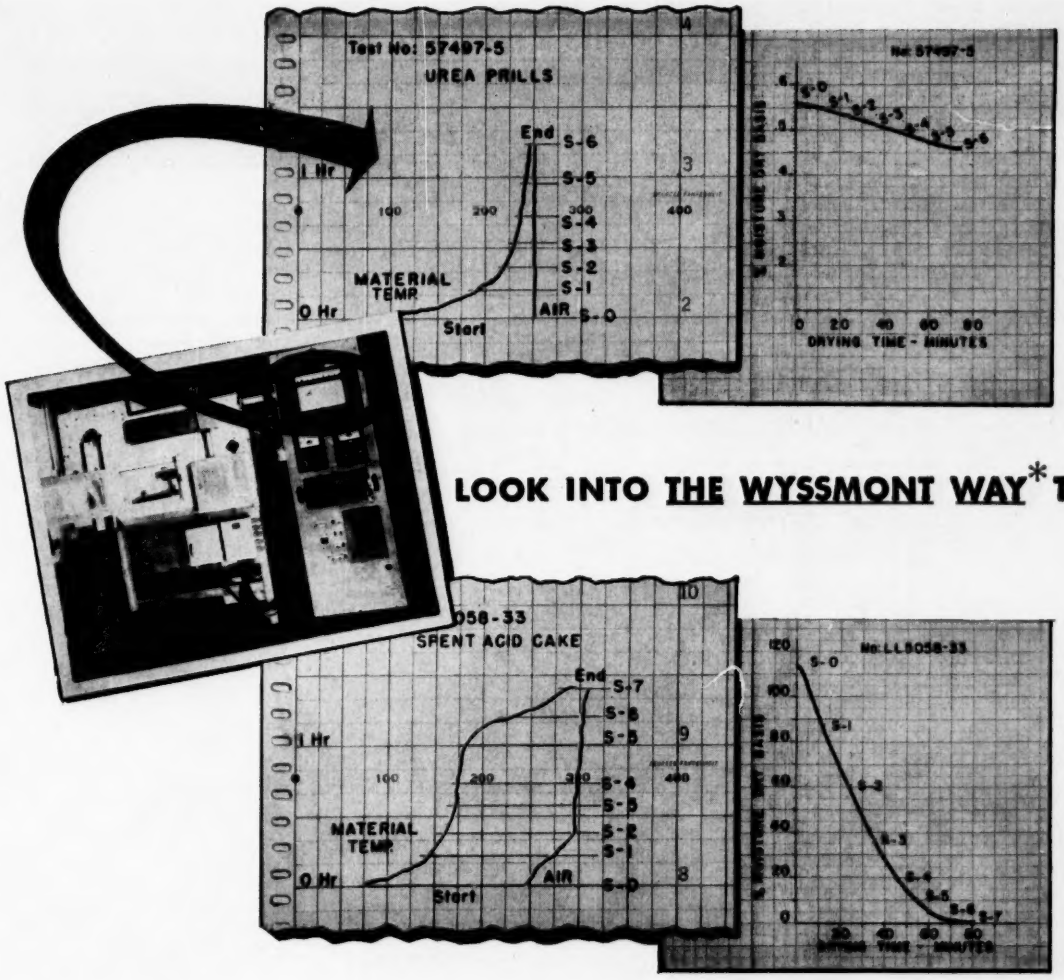

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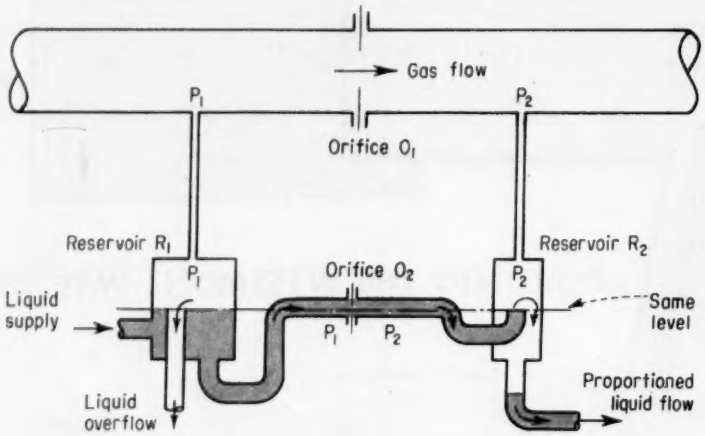


Twin Orifices Proportion Liquid to Gas Flows

With nothing but a minimum of piping, two orifices connected in parallel, and no moving parts, you can proportion a liquid flow to a gas flow.

★ **Winner of the July Contest by L. D. Brice**

Process Eng., General Electric Co., Medium Transformer Dept., Rome, Ga.

Pictured above is a simple arrangement of orifices which can be used to proportion a liquid flow to a gas flow. It is simple, has no moving parts and works on the principle of two orifices connected in parallel.

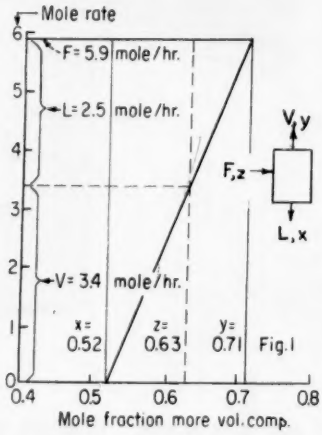
I have used this device successfully for controlling a vacuum distillation process where the flow rate of the refluxed liquid was to be kept in a fixed proportion to the variable flow of a gas in the still. The same arrangement could be used in various other situations, for example, in proportioning fuel-air mixtures or in controlling the reactants entering a process.

In the sketch, the liquid to be proportioned is fed into a reservoir R_1 in excess, so that there is always a constant level maintained by the overflow tube. R_1 is connected to and operates at the upstream pressure P_1 of gas, above orifice O_1.

A second or discharge reservoir R_2 is connected to and operates at the downstream pressure P_2 of the gas, below the orifice O_1.

A line containing a second orifice O_2 connects the supply and delivery reservoir, R_1 and R_2. Note that the liquid level in R_1, in the orifice O_2, and at the discharge point into R_2, must all be at the same elevation to eliminate any differences in hydrostatic head. Both orifices will then operate under the same differential pressure conditions and will therefore pass proportional quantities.

If desired to vary the proportions from time to time, a valve can be used in place of the fixed orifice O_2.



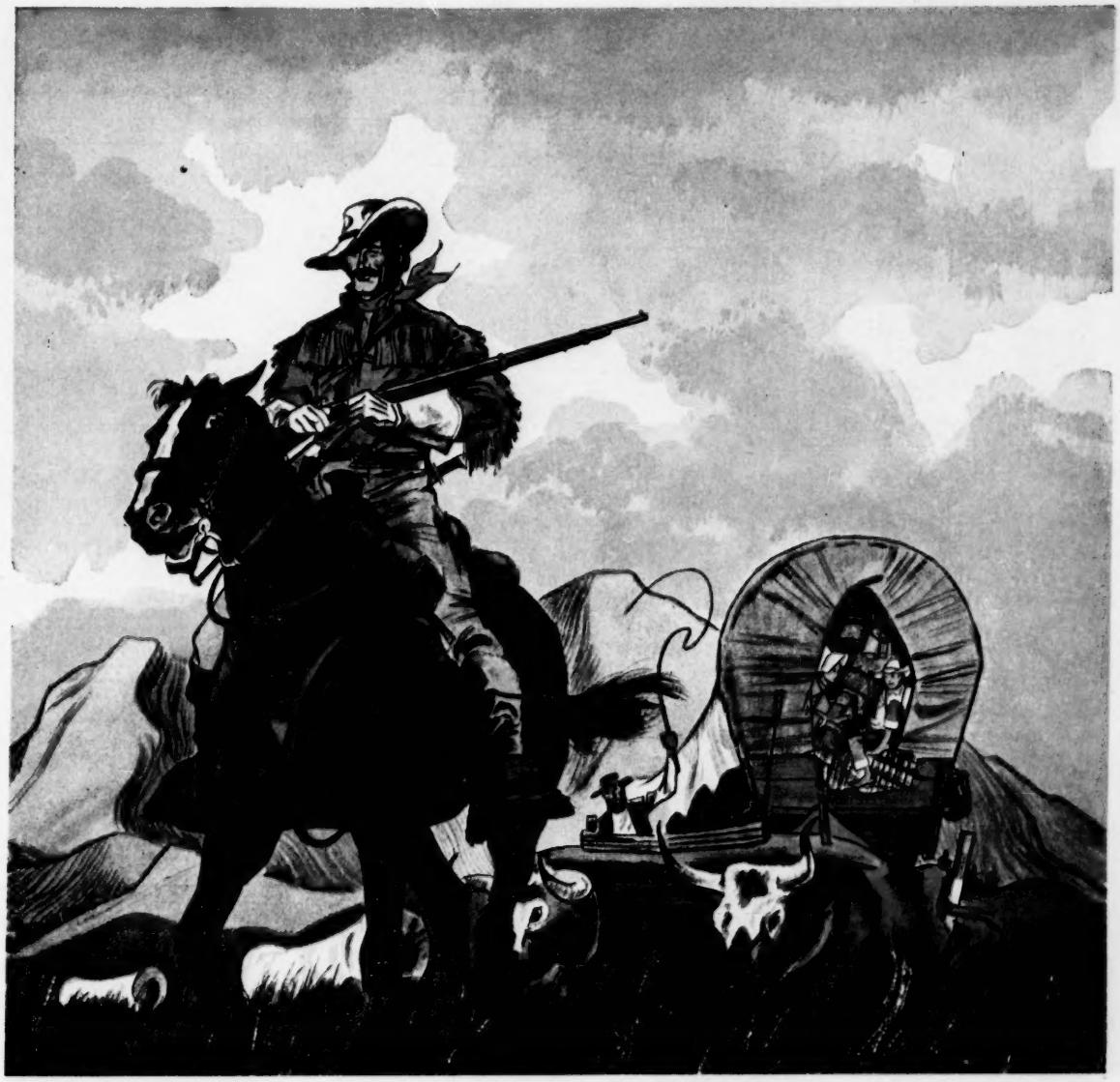
Graphical Solutions for Simultaneous Equations

F. G. Shinskey
Olin Mathieson Chemical Corp. Energy Div., Niagara Falls, N. Y.

Engineers engaged in process design work often encounter the need to solve pairs of simultaneous equations.

Solving simple simultaneous equation is high-school work. Nevertheless, the engineer appreciates graphical methods since they provide quick answers to an infinite number of condition changes and also give the engineer a visual indication of process trends.

Flash Separator—The small diagram superimposed on Fig. 1 indicates the conditions in a flash



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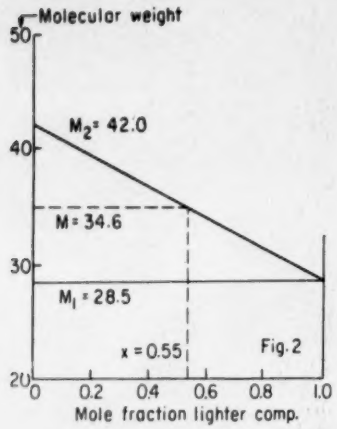


separator or partial condenser. Here F, V and L are respectively the total moles per unit time entering as feed and leaving are vapor and as liquid. The terms z, y and x are respectively the moles of A, the more volatile component, in the feed, in the vapor and in the liquid. Now, setting up the material balance: $F = V + L$ and $Fz = Vy + Lx$. Since $L = F - V$, then $Fz = Vy + (F - V)\,x$, or $F\,(z - x) = V\,(y - x)$, so:

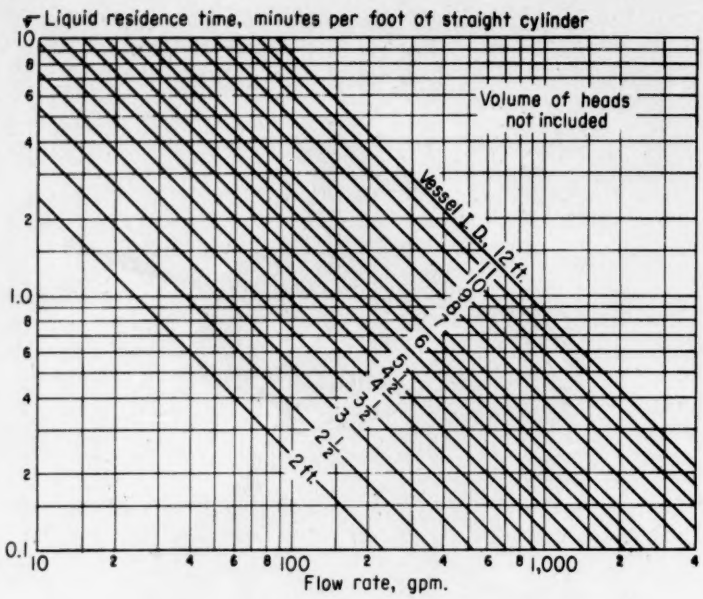
$$V = F\left(\frac{z - x}{y - x}\right)$$

Fig. 1 represents a graphical solution of this last equation. It now becomes a simple matter to observe the effects of changing feed composition z, by moving the vertical line intersecting z in either direction. Different equilibrium conditions affecting x and y will cause a different vapor-liquid split and their effects also become evident.

Gas Mixing—A problem of determining the molecular weight or specific gravity of a gas mixture can be treated in the same manner. Where M_1, M_2 and M are respectively the molecular weights of Gas 1, Gas 2 and their mixture, and x is the mole fraction of Gas 1:

$$xM_1 + (1 - x)\,M_2 = M$$
$$M = x\,(M_1 - M_2) + M_2$$

Fig. 2 illustrates the graphical solution of this second problem. It provides a convenient chart for recording velocity data, residence time and flowmeter calibrations for a gas stream whose composition varies.



Residence Time in Vessels

William J. Knapp
Process Engineer, Bechtel Corp., San Francisco, Calif.

This chart will quickly determine the residence time of liquids in cylindrical vessels. Knowing the liquid flow rate in gallons per minute and the vessel internal diameter in feet, the chart will give you the average time in minutes for a particle to flow through 1 ft. of straight cylindrical shell.

Note this does not include the volume contained in the vessel heads. For a 2:1 ellipsoidal head, for example, the volume in gallons approximately equals the cube of the diameter in feet. The chart applies to a full vessel. It can be used for partially full horizontal tanks by multiplying by the percentage of fullness.

NEXT ISSUE: Watch for August Contest Winner

★ How Readers Can Win

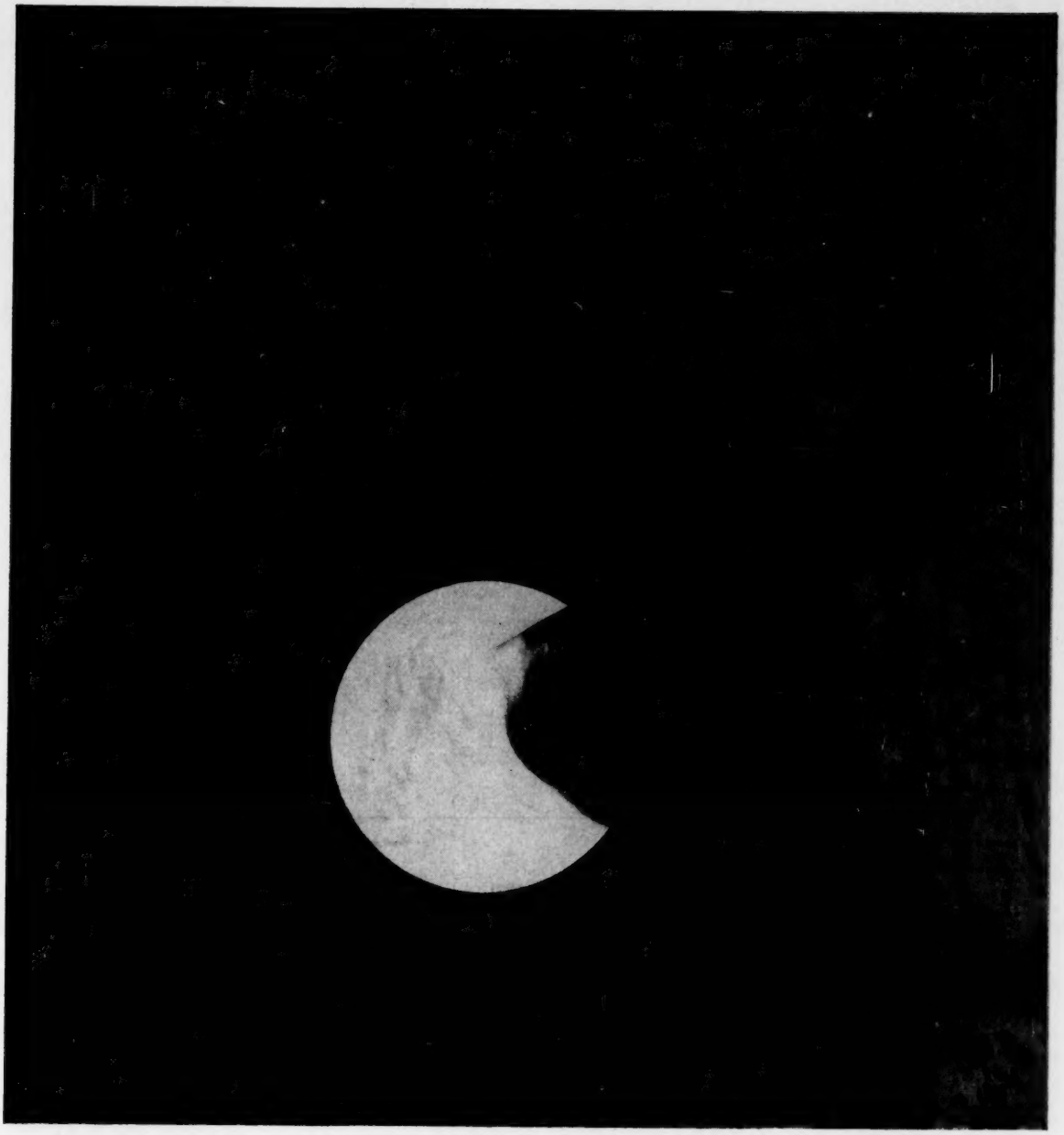
$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering* will award $50 each four weeks to the author of the best short article received during that period and accepted for Plant or Process Design Notebook.

Each period's winner will be announced in the second following issue and published in the third or fourth following issue.

$100 Annual Prize—At the end of each year the period winners will be rejudged and the year's best awarded an additional $100 prize.

How to Enter Contest—Any reader (except a McGraw-Hill employee) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable nonwinning articles will be published at space rates ($10 minimum).

Articles should interest chemical engineers in development, design or production. They may deal with useful methods, data, calculations. Address Plant & Process Design Notebooks, *Chemical Engineering*, 330 W. 42 St., New York 36, N. Y.



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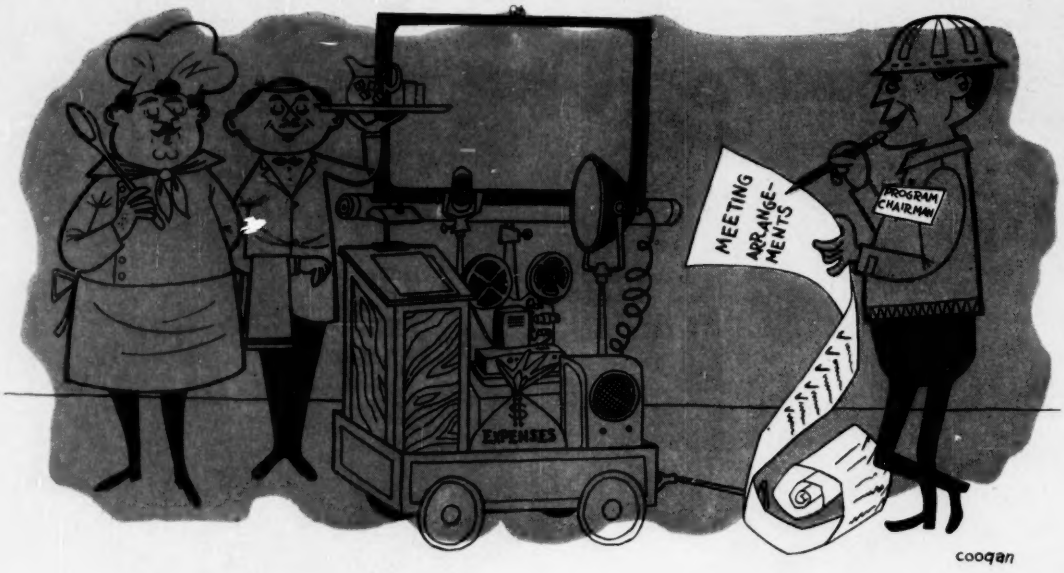


So You're the Program Chairman

Here's your guide for the care and handling of speakers. Every engineer has to be ready for the day when he's tagged to arrange and run a meeting.

Paul R. Heinmiller, General Electric Co., Schenectady 5, N. Y.*

At a recent ladies' night banquet of an engineering society, the guest speaker was scheduled to begin at 8:00 P.M.

He finally started at 9:45, after new officers were installed, guests introduced, committee chairmen and their committee members recognized and entertainment rendered by the local high school choir and a native troupe of comedians.

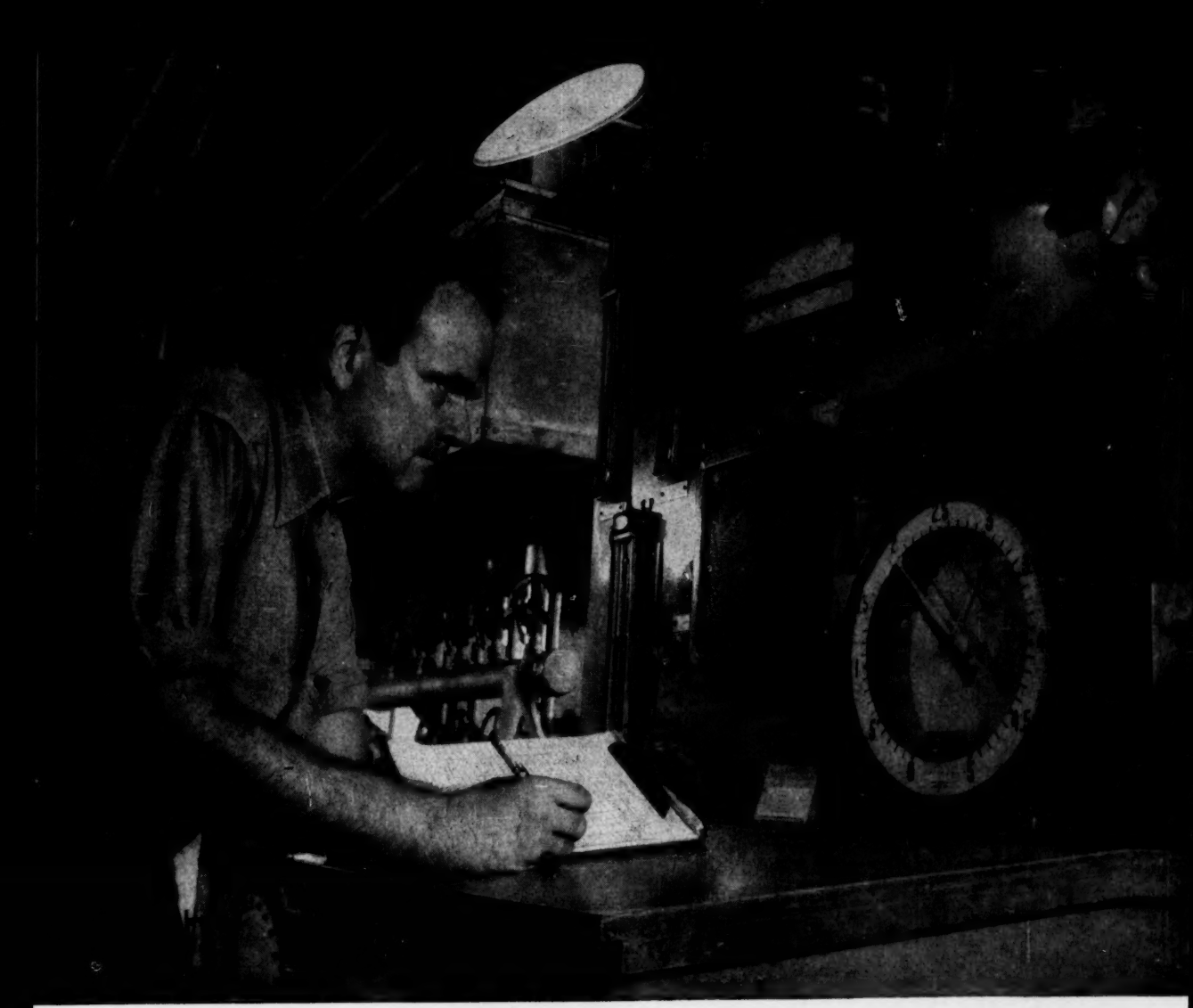
That the speaker was able to hold the audience—surfeited by cocktails, a full-course dinner and "preliminaries"—was a tribute to his skill and not the farsightedness of the program chairman. Such treatment of the speaker is indeed inconsiderate.

What can the program chairman do to help the speaker give a more effective presentation? What are some of the techniques used by seasoned chairmen in getting the most out of the speaker and at the same time making the engagement one of pleasant memories for the speaker?

You may think the answers to these questions are not important to you.

But any day your local engineering society, or your em-

* To meet your author, see Part I of this two-part series, "So You've Been Asked to Give a Speech," *Chem. Eng.*, Sept. 7, 1959, p. 164.



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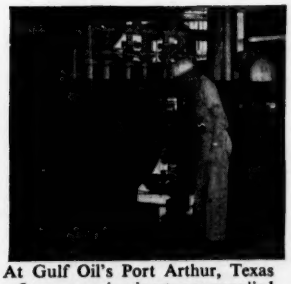

At Gulf Oil's Port Arthur, Texas refinery, purging inerts are supplied by Kemp Generator and Kemp Dryer working as a team. The units produce 30,000 SCFH for a bountiful and easily controlled supply at low cost.

Tested . . . and proved! Factory tested with rigid component checks, field tested by Kemp engineers at installation, and time tested by years of actual use. Proved that Kemp Inert Gas Generators are built to last, built to produce, built to be accurate.

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And Kemp design—rugged, simple, and sturdy—means that maintenance and attendance requirements are kept to a bare minimum. Kemp Inert Gas Generators stand up under the toughest conditions, yet produce with complete dependability.

Your Kemp Representative is listed in *Chemical Engineering Catalog*. Give him a call for more information, or write direct for Bulletin I-10. THE C. M. KEMP MFG. CO., 405 East Oliver St., Baltimore 2, Md.

Convection Dryers

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GIVE YOUR SPEAKER a well-marked city map ahead of time.

ployer, could tag you with the responsibility for arranging the program for an upcoming meeting. Part of the professional stature you achieve will depend on how effectively you handle the assignment.

This article won't tell you how to select and obtain a speaker. But it will tell you how to treat him after he accepts your invitation. These ideas will not only make your programs more effective but also the speaker's visit pleasanter.

You need only to remember and carry out the important points outlined below.

Negotiate Early

The earlier you begin to line up a speaker for your program, the better your chances are of getting the speaker you want. It flatters the speaker to know that he is your first choice, not one who was asked at the last minute because others refused.

Also, early negotiations give you ample time to clear up many small but necessary details.

Identify yourself. You're the speaker's lone contact with the sponsoring organization. Be sure he knows your full name, title, company address and phone numbers where you can be contacted, both at your office and at home.

Give the speaker all the information you can about the audience: Will it consist entirely of professional engineers interested in one subject only or will it be a cross-section of many professions? Is it a ladies' night? Will science students from local high schools be invited because of their interest in the subject? And what will be the size of the audience?

Answers to these questions will help the speaker tailor his presentation exactly to the needs of his listeners.

Tell Exactly Where and When

Give the speaker the exact name and address of the hotel, club, school or auditorium where the meeting will be held; and some background of the location, if necessary. Tell him the date, time the meeting will start and whether a dinner, cocktails or both will precede the meeting.

Advise the speaker of the time he will begin speaking and briefly describe the program that will precede him. Also supply the name and title of the person who will introduce the speaker.

How long do you want the presentation to run: 20, 30 or 40 minutes? Tell the speaker precisely.

If a strict timetable is customary, let him know it. If you're planning a program for a service organization such as Kiwanis or Rotary, tell the speaker that the meeting should be adjourned by 1:30.

If it's customary to have the speaker answer questions afterwards, ask him in advance if he'll agree to do so. And tell him whether the question period is in addition to his scheduled time or should be allowed for when planning his speech.

Ask About Travel Plans

Offer transportation from the railroad station or the airport, suggesting a taxi or airport limousine if suitable.

Of course, meeting the speaker's train or plane itself is a hospitable gesture. If necessary, also be sure to plan transportation for the speaker from his hotel to the meeting location.

Offer to make the speaker's return transportation reservations. He'll probably have them already, but he'll appreciate your thoughtfulness.

If the speaker is driving to your city, send him a detailed city map to help him find his hotel or the auditorium. Also suggest parking arrangements. A map is vitally important if the meeting place is relatively inaccessible or unknown.

If the speaker plans to arrive the evening before, or to stay overnight following his speech, offer to make hotel (or motel) reservations.

Determine ahead of time whether your speaker will be available for interviews with representatives of the local press, radio and TV. Get this information early. Your publicity chairman can then follow through and make the proper arrangements. As soon as interviews are lined up, notify the speaker and give him all the important details.

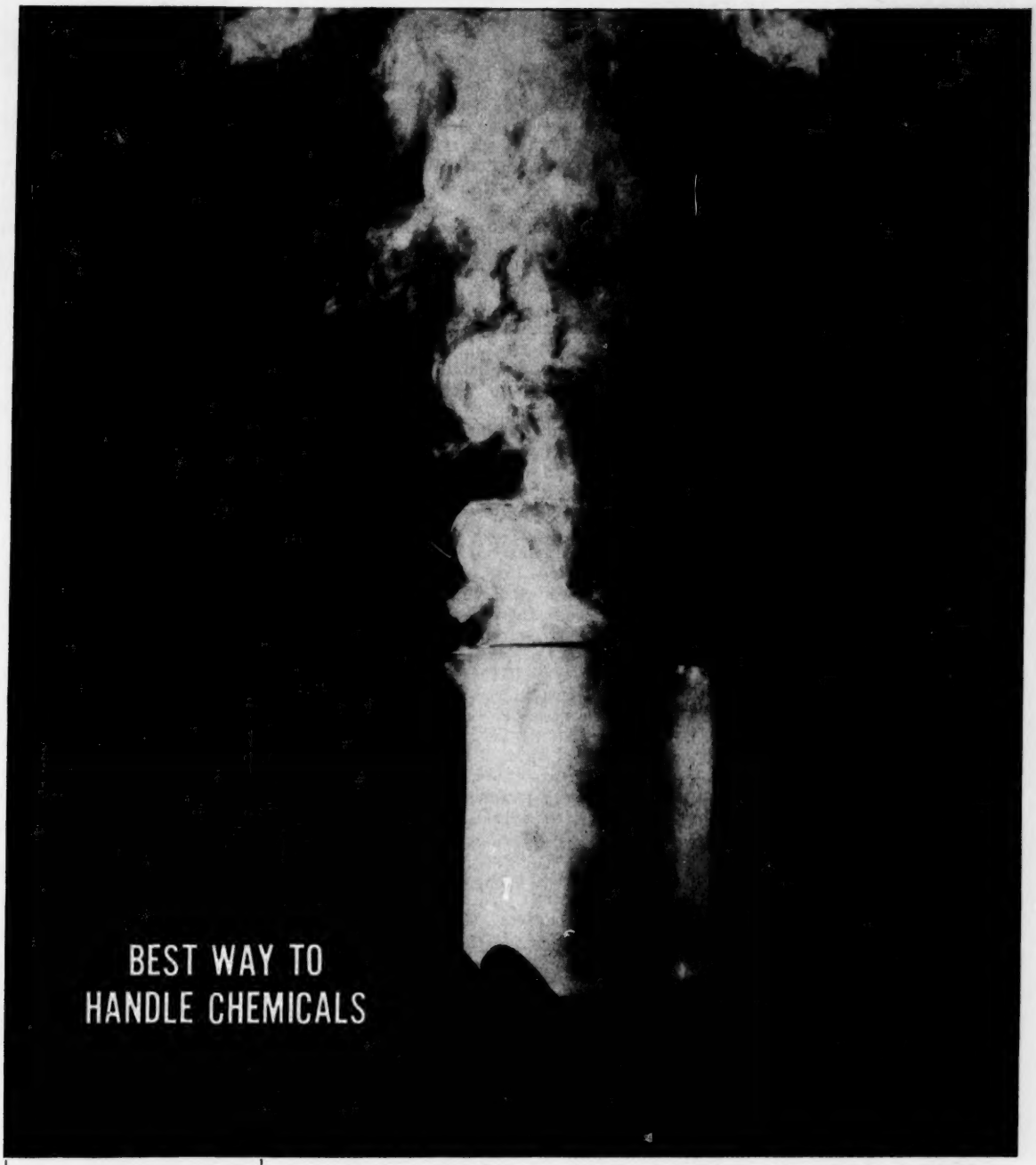
If you foresee a demand for reprints of the speaker's speech, let him know ahead of time so that he can handle the necessary details from his end.

Request Mechanical Requirements

Obtain from the speaker ahead of time—the sooner the better—a complete list of the equipment and facilities he will need.

After you receive the list, check *personally* the auditorium where the meeting will be held. Find out the location of light switches, electric outlets and public-address system controls, and assign these details to a responsible person.

When you must furnish a slide or movie projector, rent the best.



Here are a few of the many chemicals that Butyl offers excellent resistance to:	
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Enjay Butyl rubber, due to its unique and extremely low degree of unsaturation, offers excellent resistance to corrosive chemicals. Versatile Butyl is the preferred rubber for countless types of hoses, tank linings, gaskets, seals—and many other applications where exacting chemical resistance is required.

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GET THE PROJECTOR set up and in focus ahead of time.

And get an alert and experienced projectionist, a person who is familiar with the equipment and who knows how to change a bulb or to rethread a broken film.

Auditoriums and hotels in larger cities may require you to use union projectionists. Don't leave this detail until the last moment.

Find out if a projection screen is available. If it's unsuitable, get one of better quality. Check the relationship of the screen to the speaker's lectern. It's usually best to have the speaker near the screen. He can point out interesting details, and his commentary is more realistic when the words seem to be coming from somewhere near the screen rather than from the rear of the auditorium.

But watch for light spill from the speaker's reading light onto the screen. Light spill will wash out slides and movies; it can be corrected easily by a simple adjustment of the lectern and by suitable shading of the reading light on the lectern.

Another factor: be sure that the lectern or other pieces of furniture or equipment do not interfere with sight lines from any part of the auditorium.

Check the public-address system. The quality of those in hotels has improved over the years, but many still leave much to be desired. If necessary, rent a good sound system. Many speakers prefer neck microphones because they permit greater freedom and flexibility.

Who will turn out the lights when the slides begin? Who will turn them on again? Get this settled ahead of time and work out simple cues with the speaker. He'll appreciate your help because a minor effort like turning lights off and on at the proper time can do much toward giving his presentation an air of professional competence.

(Be sure that turning off the lights doesn't also turn off the projector!)

Don't underestimate the importance of the speaker's reading light on the lectern. If it's too bright, it will blind him by causing too much contrast between the white paper of his speech and the darkened auditorium.

If it's too dim, he won't be able to see what he's reading. And be sure the lamp is shaded properly to prevent light from spilling on the screen or glaring into the eyes of the speaker or the audience.

When possible, a small spotlight—with its beam fully controlled and dimmed somewhat—should be directed on the speaker from a high location across the hall from the speaker. The spotlight relieves the macabre effect of the lectern light, yet does not spill onto the screen.

Agree on Expenses

If your organization gives the speaker an honorarium or picks up his travel and living expenses, tell him in your transmittal letters.

Should you have no budget for such items, make it understood at the outset. If you are covering an honorarium plus expenses, tell the speaker the details—whether he is to submit a bill at a later date or take care of it the day of the engagement.

When these details are being handled by the speaker's booking agency, they will cover this item in the greatest detail.

If a dinner jacket is required, inform the speaker. If dress is optional, let him know. If you don't mention dress, the speaker will assume a business suit will do.

If it's a summer engagement at a lodge or country club and sport clothes are customary, tell the speaker so he won't feel out of place in a business suit.

It's not necessary to schedule the speaker's every free minute. Do what you believe is necessary and appropriate, but leave him some time for himself.

Not all speakers want to be busy right up to the hour of their talk. Give him a chance to relax, shave and shower in his hotel room for an hour or two. If the speaker has a free evening, arrange suitable entertainment, or suggest it.

Invite the speaker's wife, if you have activities planned for wives. Even if it's a purely technical session, ask the speaker if his wife is accompanying him. If she is, suggest or provide appropriate entertainment for her.

Check and Double Check

On the Big Day make sure the speaker has arrived, that he is well and that accommodations are satisfactory.

Check the facilities at the auditorium. Get the projector set up ahead of time and in focus if possible. Check out all other facilities: lights, public-address system, lectern, etc.

It's these little items that pay off in a big way during the speech.

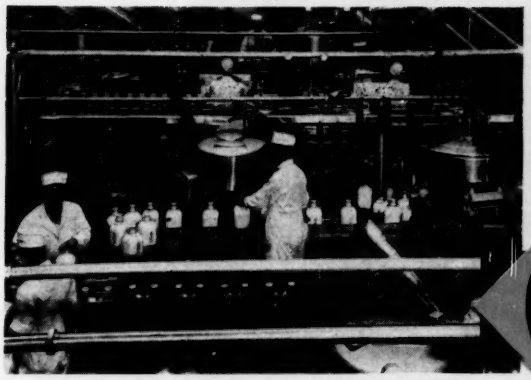
Introduce Him Correctly

Not everyone who speaks on science and engineering today has his doctor's degree, even though some program chairman make it almost a habit to bestow such degrees when introducing a speaker.

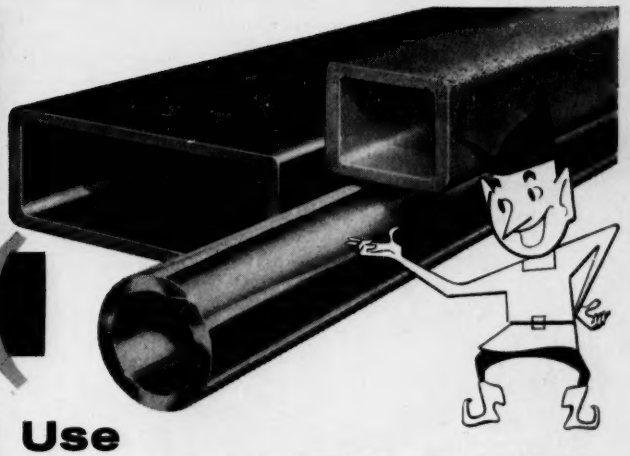
Don't violate the speaker's correct title just to endow your program with a little more doubtful glamour and to make yourself seem a little more important because you associate only with the top intellectual strata.

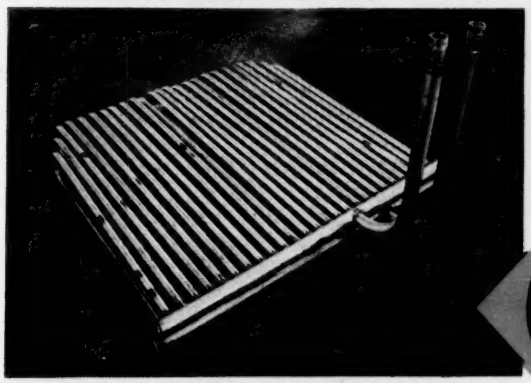
By following these check points, you'll make the event pleasanter for the speaker. In turn he'll have a high regard for you, your organization and your city.

And, even more important, an effective, smooth-running program will increase your stature in the eyes of your associates—and probably get you the job of program chairman the next time.

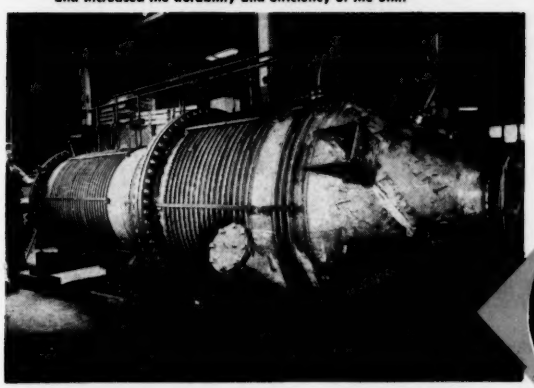


In dairy products, sanitation, non-contamination, heat and cold requirements dictate *welded* stainless steel tubing.





This heating coil of welded stainless steel tubing replaced lead coils and increased the durability and efficiency of the unit.



This all-stainless steel resin distillation unit relies on *welded* stainless steel tubing for all tubular components.

Liquid sample cooler demonstrates the ready fabrication properties of welded stainless steel tubing. ¼" OD x 20 ga. Type 316 is coiled; 3½" OD x 16 ga. makes up the shell.

Use WELDED stainless steel tubing to resist

- CORROSION
- HIGH TEMPERATURE
- CONTAMINATION

Where applications involve combinations of corrosion, pressure and temperature—where freedom from contamination is a must—where durability and low maintenance are key factors of economy—use Welded Stainless Steel Tubing.

In all these applications for tubing and pipe, the uniformity, concentricity, dimensional accuracy and range of sizes, shapes and grades of *welded* stainless steel tubing serve best. To be sure—specify welded stainless steel tubing and pipe from your quality tube producer.

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PRACTICE . . .

OPERATION & MAINTENANCE

EDITED BY M. D. ROBBINS

Do You Really Have Temperature Control?

This is the first of a series in which an "old pro" will pass along some of his 30 years experience and know-how, to help you in your plant operations.

WINGATE H. RICHARDSON, Consultant, New York, N. Y.

We were talking the other day about some of the problems encountered in temperature measurement and I got to thinking about the night I learned to "operate with the door." Perhaps you would be interested in the story.

I inherited responsibility for operating a catalytic vapor-phase oxidation that had been in production for a number of years but was always plagued by control problems.

One of these was temperature control. In the simplest terms, temperature was controlled by introducing an inert gas into the reaction stream.

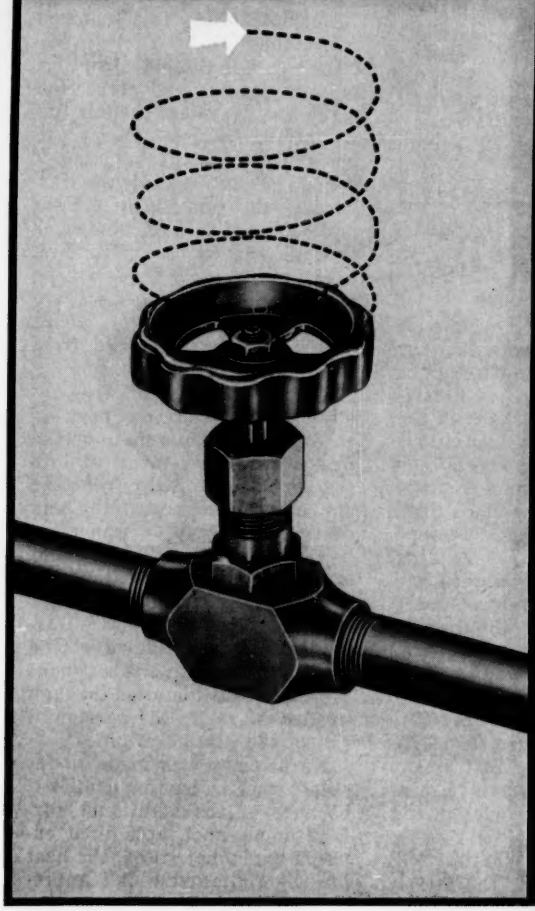
During the years, nearly every new instrument brought out by the instrument people had been tried with varying degrees of success. The operators still found it necessary to exercise considerable manual control by frequent resetting of the control points in the various instruments.

▶ **Here's the Trouble** — There were two basic conditions that made control difficult:

The reaction was a partial oxidation that took place between very narrow temperature limits. With a drop of about 10 deg., the flame went out entirely and the converter cooled abruptly. This usually meant a complete shut down in order to start up again with external heat.

If the temperature increased by about 10 deg., then the reaction shifted to complete oxidation and the temperature rose rapidly out of control and it was necessary to shut down.

FLO·BALL 715 makes needle valves obsolete



WHICH VALVE CLOSES FASTER?

Unlike the many turns required to operate a needle valve, the Hydromatics ***FLO•BALL 715,*** shown on the right, closes instantly with a mere ¼ turn . . . **positive action** at flow pressures up to 3,000 psi with just a 4 inch-pound torque! And the arrow-shaped handle shows both open and closed positions at a glance. Exclusive ***FLO•BALL*** straight-thru design has 100% flow efficiency—more than double the flow of needle valves.

Ideal for leakproof control of air, vacuum, steam, water, fuels, oils, kerosene, alcohol, etc., the ***FLO•BALL*** features zero leakage, universal mounting, removable flanges, and all stainless steel construction.

Write today for a complete catalog describing this valve and others for corrosive and cryogenic media. Also special designs for throttling flow control.

The *FLO•BALL* costs no more than old fashioned screw-type valves!

Hydromatics, Inc.

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FLO-BALL

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Exceptional engineering employment opportunities—write today!

Because of this condition, control instrumentation efforts were directed towards increasing sensitivity and speed-up of control action.

However, and here was the rub, the converter had a tremendous heat capacity in proportion to the rate of heat liberation and therefore the response time was slow, no matter how fast the control compensation operated.

Result was that when the temperature started to drop, the inert gas flow was decreased to bring up the temperature, but because of the lag caused by the heat capacity of the converter, by the time the temperature returned to the control point, the reaction was already out of control on the high side. If the temperature started up, then by the time it could be brought back to the control point, the reaction had ceased entirely.

▶ **Operators Needed Convincing**—We changed our thinking about speed of control and went to the other extreme, using low sensitivity, and slowing down the rate of change of feed streams. At the same time a number of other variables were put under better control, pressure was an important one.

After a number of alterations the control system was considered very satisfactory.

At this point, some operator difficulty developed. Because of their long experience with anticipating controller requirements, and therefore their habit of frequently resetting the control points, it became necessary to convince the operators that the control system would in fact, control the process satisfactorily—if they would only leave it alone and give it a chance to operate.

Ultimately, they became at least 95% convinced of this and I felt I had accomplished a satisfactory solution to a difficult problem.

▶ **Then I Learned**—How to "operate with the door."

It was my custom to stop in at the plant during the night hours to make a casual inspection of operations and to pass the time of day with the operators.

Wingate H. Richardson

The author, a graduate chemical engineer from Ohio State, has been in this business of designing, building and running chemical plants for some 30 years. He's had experience in everything from essential oils to high explosives.

During the night hours, with the offices closed, and with other departments shut down, such as shipping, or reduced to a minimum of activity, such as the maintenance shops, conditions are good for quiet conversation with the operators. A little teaching can be done and a little additional education obtained from the operators.

On this particular night I had been talking to the operator while he stood at the instrument panel watching the operation of his control instruments.

Presently, he excused himself and walked over to the big outside doors and opened them. He returned to the instrument panel and after about five minutes returned and closed the doors.

So I said, "O.K., What gives?"

"Oh", he said, "Don't you know about operating with the doors" I replied, "No I don't, but I sure want to learn."

▶ **They Had a Gimmick**—Well, it developed the operators had observed that by opening the outside doors, the cold air coming in across the converter (and the protruding end of the thermocouple) would drop the temperature indicated on the controller by 5 or 10 deg.

If this was done when the temperature had started to fall, they could in effect get some pre-action from the controller.

If, on the other hand, they opened the door when the temperature was rising, as I learned later some of the operators did, then the recorded temperature was brought back to the control point although the reaction itself was in fact still out of control. This latter action delayed the control action and occasionally allowed the temperature to get completely out of control.

Needless to say this required correction.

▶ **Layout Was Simple**—In order to understand the correction made on the thermocouple installation, it's necessary to briefly describe the layout.

Flow of gas through the converter was from top to bottom and hot gases left the converter through a short section of 8-in. pipe connected to a tee at the lower end. From the tee there was a horizontal run of about 4 ft. to another tee, and from here to the recovery system.

The thermocouple was installed in a vertical position through the bottom plate on the first tee and extended up into the discharge nozzle from the converter. The protruding end of the thermocouple was close to the floor and got full benefit of the cold air coming along the floor from the door.

▶ **Solution Just as Simple**—During the next shut-down period a new thermocouple tube, about 4-ft. long, was installed through the second tee in the horizontal run of the discharge pipe.

No attempt was made to insulate the protruding end, but because of the additional surface of thermocouple tube exposed to the hot gases, the heat loss by radiation didn't appreciably affect the temperature of the thermocouple junction at the far end of the tube.

This was a fairly simple and easy solution to the problem. Unfortunately, such a simple solution to a thermocouple installation isn't always possible.

▶ **Measurement Is the Key**—Another story along the same lines might be of interest in pointing up the difficulties of temperature measurement. I had gone along with a party of "brass hats" to inspect the facilities and evaluate work being done for our organization by a development laboratory, working on a contract basis.

During inspection of the laboratories we were being given the Madison Ave. treatment and I thought a number of important points were overlooked.

NO MOVING PARTS

Designed to indicate media level changes through simple differential capacitance measurement, the new Robertshaw Level-Tel 154 contains no moving parts to clog, wear or jam.

SIMPLE TWO-STEP CALIBRATION

Only two quick, non-interacting adjustments are necessary to calibrate the new Level-Tel 154.

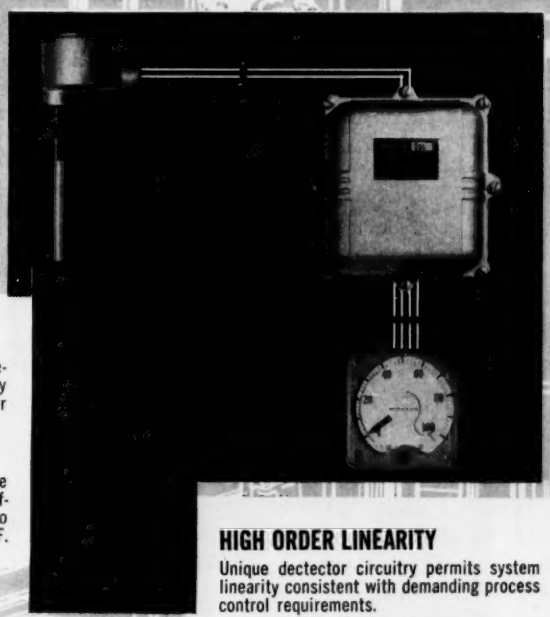
ANTI-FOULING PROBES

Self-cleaning Teflon probe assemblies remain free of deposit build-up, are unaffected by most cohesive substances.

Built to handle the Tough Jobs!

New Robertshaw

CONTINUOUS LEVEL INDICATOR



REMOTE INSTALLATION

Over 200 ft. cable length permissible between probe and transmitting unit—virtually unlimited cable span between transmitter and indicator unit.

WIDE TEMPERATURE RANGE

Detector circuitry operable in temperature environments from −30° to +212°F. Teflon insulated probes from −325°F to +350°F, Uninsulated probes up to 850°F.

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Unique dectector circuitry permits system linearity consistent with demanding process control requirements.

BUILT-IN TEST CIRCUITRY

Functional system checkout and calibration are simply accomplished by depressing a test circuit button on the control panel indicator.

SIMPLE MAINTENANCE

Printed circuit wiring and plug-in provision for critical components assure minimum maintenance time.

SET POINT CONTROL

High and low level indicator set points adjustable at control panel.

The Level-Tel 154 is a precise, continuous reading level indicating system consisting of a probe detector, transmitter, and indicator. The probe condulet houses a miniaturized capacitance bridge circuit, energized by a regulated Hartley oscillator in the transmitter. In operation, the probe detects media level change as a change in capacitance, unbalancing the capacitance bridge. This out-of-balance condition is fed to the indicator via the transmitter as a DC signal proportional to the level change.

The new Level-Tel 154 is ruggedly designed for accurate operation. It may be used with nearly all liquids, slurries, powders and granular solids. Virtually insensitive to temperature and pressure extremes, the system functions reliably under difficult conditions, i.e., interface, mass measurement, corrosive materials, food processing, cryogenic liquids, combustible substances, and abrasives. It is available in either explosion proof or water tight housings. Let the modestly priced Level-Tel 154 start saving you money now! Write for Bulletin RF-5915 and the address of our nearest technical field representative.

ENGINEERS! *Dynamic growth offers expanding opportunities to qualified EE's and ME's. Send resume to R. A. Sweeney.*

Robertshaw CONTROLS

AERONAUTICAL AND INSTRUMENT DIVISION

SANTA ANA FREEWAY
AT EUCLID AVENUE
ANAHEIM,
CALIFORNIA

I stopped to talk to one of the operators and mostly for the sake of raising a question, merely for the purposes of starting a discussion, I asked him why the tempearture recorded on one of the instruments on the panel board had dropped 10 deg. at 9:00 a.m. that morning.

He was somewhat puzzled at first and explained there had been no change in operating conditions. Temperature under discussion was the reboiler temperature in a distillation operation.

He excused himself to check the log book but he found no explanation there.

Finally, he remembered what had happened at 9:00 a.m. and with obvious relief explained that the room had become warm about that time and they had turned on the fan of the unit heater, (the steam was off of course) to provide a little cooling.

This cooling stream of air also cooled the protruding end of the thermocouple in the reboiler and therefore, the temperature drop on the chart.

It apparently didn't occur to him that he was no longer recording the reboiler temperature, and in fact probably never had been.

In this case, a solution would not have been as easy as it was with the converter, since it would have been impossible to install something like a 4-ft. thermocouple.

Certainly, the thermocouple should have been insulated from the effect of the fan but it is doubtful if this would have been a complete answer.

▶ **Heat Always Flows**—Heat is one thing you can't contain. Insulation reduces the loss, that is, reduces the flow of heat, but it doesn't stop it.

And, heat flows practically in all directions, through the thermocouple wires and tube, through the thermocouple well to the walls of the containing vessel, etc. Temperature is therefore almost always measured in a flowing stream.

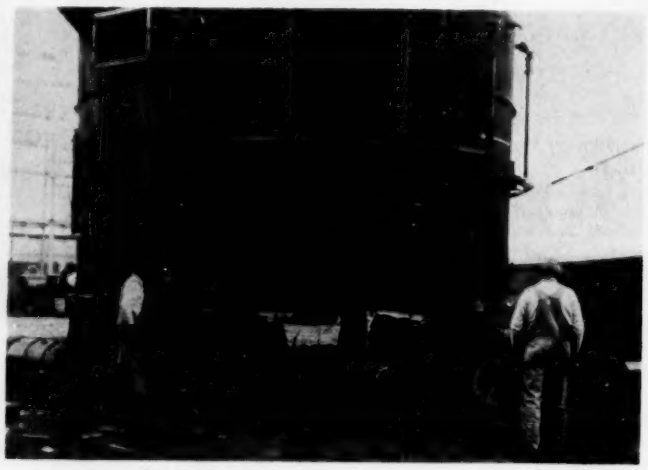
▶ **What Can We Do?**—It seems to me, the instrument boys could come up with a null-balance system that would give us a precise method of sampling temperature.

The original null-balance I guess must have been the old Wheatstone bridge for measuring electrical potential. This principle is now in common use in pneumatic transmitters. Why not for temperature?

Use a thermocouple well with two junction points 6 in., or so apart; Use the end junction for the measured temperature; Use an electrical heating unit with the second thermocouple in order to maintain the second temperature at the same level as the first.

Result: no heat flow, null balance.

Expensive? Yes, but considering the expense put into some of the instruments now used to achieve high accuracy in determining the thermocouple potential, wouldn't a little expense be justified in getting an accurate primary temperature sample?



Novel Construction Bypasses Explosion Hazards

Even the simplest of construction jobs sometimes present safety hazards that leave no other choice but to devise involved routes to avoid it.

At Clinton, Iowa, Blaw Knox's Chemical Products Div., in installing a new continuous solvent extraction unit for the Clinton Corn Processing Co., ran into a potential explosion hazard.

Construction of the new extractor was to take place without interrupting operations on the existing facility—a unit using hexane as a solvent.

Solution was to assemble and weld the new extractor outside the building; then, move it into the structure. This avoided many of the safety problems posed by construction and welding near the operating unit.

When the unit was assembled —40 tons, 14-ft. high, 24-ft. dia. —it was lowered by hydraulic jacks onto four, eight-wheel dollies, as shown in the above photograph.

Entire unit was then pulled into the building and erected with permanent supports.

HIGHER Thermal Efficiencies . . . . . GREATER Savings In Industrial Process Heating!

THE HI-TURBIANT HEATER

If you have any process operations — large or small — where process fluids are heated, directly or indirectly, investigate now the substantially greater thermal efficiencies and lower operating costs the Hi-Turbiant Heater is bringing to other processing applications similar to yours.

▶ As shown in the cutaway view, the Hi-Turbiant has both radiant and re-radiant heating zones — a unique advancement that insures more uniform heat absorption throughout the entire tubular network!

▶ High fluid turbulence, maintained by high-temperature pumps, reduces boundary-layer vaporization and assures substantially greater heat efficiencies without vaporization problems!

▶ More uniform heating permits greater height-to-diameter ratio — therefore fewer "hairpins" in the tube system for more efficient fluid flow, lower pumping costs, greater operating economies!

Because of these and other unique Hi-Turbiant advancements, you make multiple savings in process heating applications — savings in size of unit required, savings in fuel costs, savings in pumping costs, savings in plant space. Send for illustrated bulletin that gives detailed data and shows typical systems. *Ask for Bulletin # HT-100!*

TWO BROAD FIELDS OF APPLICATION!

1. Heating Transfer Fluids (Dowtherm, Aroclor, Hydrocarbon oils, etc.) used in heat processing.
2. Direct Firing of process streams (Rich-Oil denuding, asphalt heating, etc.) where fluids must be heated under close thermal control.

In both types of application, the Hi-Turbiant Heater brings new standards of efficiency, new savings in processing costs!

COMPLETE RANGE OF SIZES — ½ TO 40 MILLION BTU/Hr.

Also, single user "package" units 200,000 to 1,500,000 BTU/Hr.

There's a Hi-Turbiant Heater to fit your requirements!

Z-122

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Jet-Cleaned Filters
THERM-O-FLEX Hi-Temp Filters
TURBULAIRE-DOYLE Scrubbers
HOLO-FLITE Processors
HI-TURBIANT Heaters

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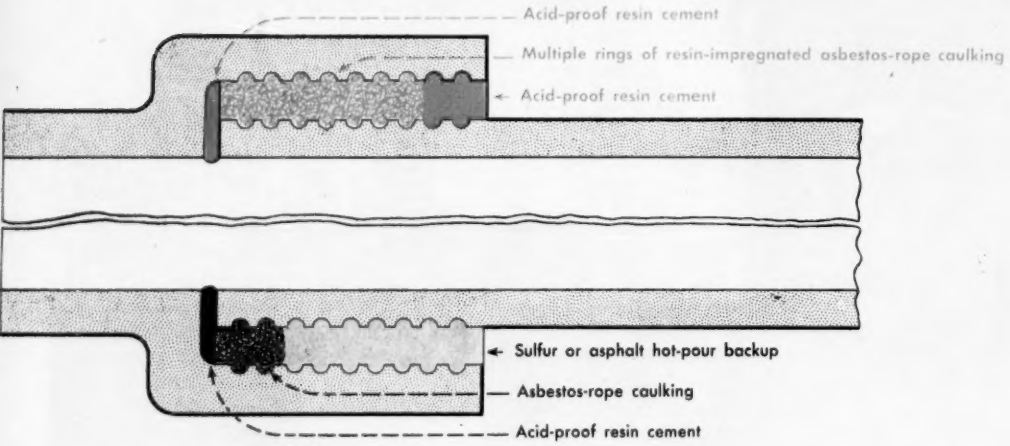
NEW METHOD:
has all-resin joint, eliminates product contamination



OLD METHOD:
permits sulfur or asphalt contamination at joint

A Better Way to Join Stoneware Pipe

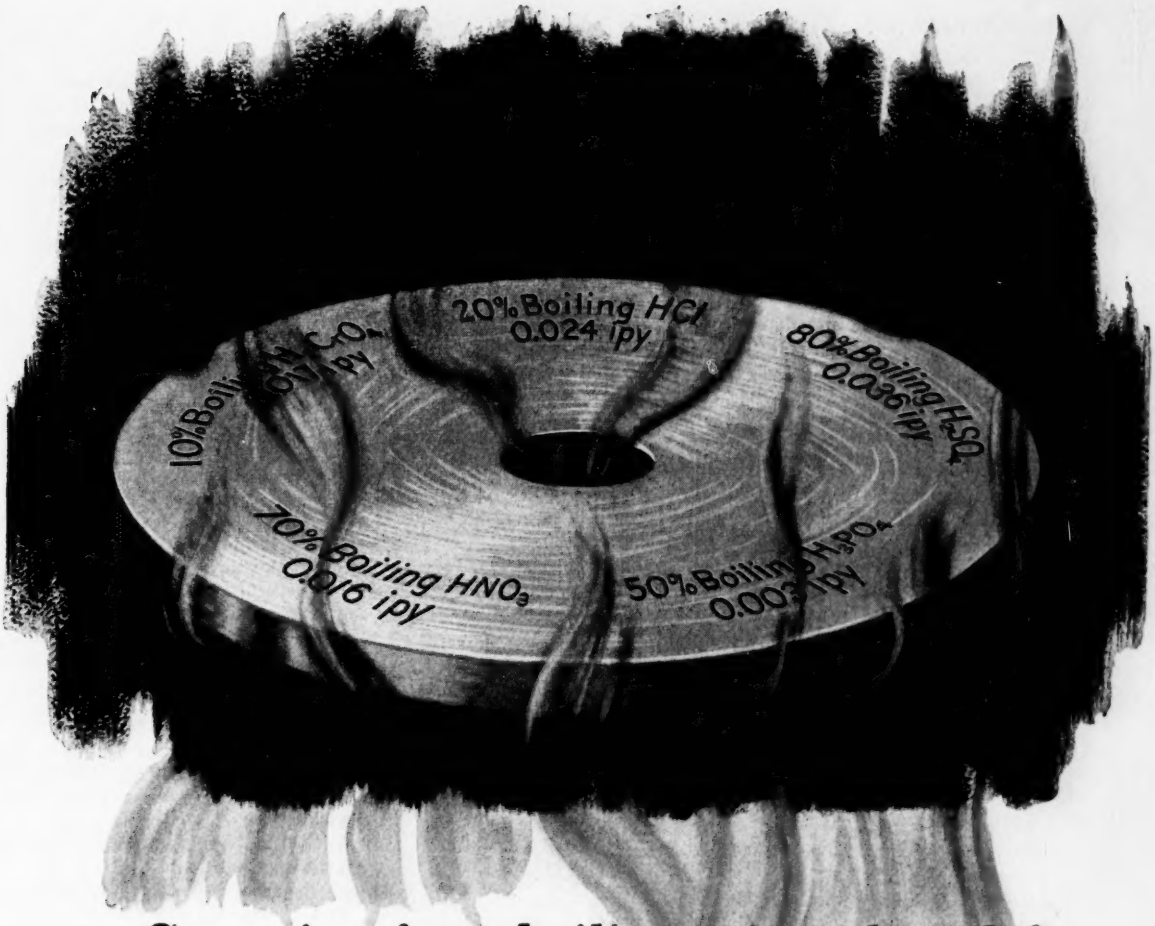
New idea in masonry construction has all-resin joint. Standard methods permit contamination of process liquids, through leaks, with sulfur or asphalt cements.

B. C. Haworth, Eng. Service Div., E. I. du Pont, Wilmington, Del.
J. M. Stokely, Const. Div., E. I. du Pont, Wilmington, Del.

Conventional techniques for joining chemical stoneware leave much to be desired, particularly when high product purities are involved.

We have developed an improved all-resin-cement masonry joint, which resists various process streams and avoids product contamination. This joint is practical and economically competitive with standard acidproof construction.

► **Avoid Contamination**—Chemical stoneware (not to be confused with terra cotta pipe) is often used in chemical plants for economy and to avoid metallic corrosion and contamination problems. Metal ions can be very detrimental to a number of end-product chemicals: iron pickup, for example, discolors caustic soda.



Corrosion from boiling mineral acids?

TEST "HAYNES" ALLOYS

The low corrosion rates on the test specimen indicate the remarkable resistance of HAYNES alloys to mineral acids . . . even at the boiling point. These alloys reduce corrosion damage and product contamination from mineral acids at all temperatures. You will find, too, that they have outstanding resistance to chlorides, halogens, mixed acids, and alkalies.

The penetration rates shown on the disks were obtained as a result of laboratory tests. How closely will they match up with data obtained under actual operating conditions? You can find out for sure by testing them.

We'll be glad to send you samples. But to narrow down the number, we suggest you send us a letter outlining your corrosion problem. For full information on HAYNES corrosion-resistant alloys, their properties, forms, the corrosives they will resist, ask for a copy of our 104-page book.

HAYNES
ALLOYS
HAYNES STELLITE COMPANY

Division of
Union Carbide Corporation
Kokomo, Indiana

UNION CARBIDE

The terms "Haynes" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

But in joining chemical stoneware, conventional techniques void many of stoneware's advantages. The sulfur or hot-pour mastics used to seal joints can be a serious source of process or product contamination.

Consider construction of a standard acidproof resin-cement joint (see sketch):

- Trowel appropriate resin cement into socket or bell of pipe.
- Apply cement to spigot end (plain end) of pipe.
- Shove spigot end of connecting pipe into resin cement until it seats against bottom of the socket or bell.
- Tamp a ring of asbestos rope on top of resin cement. Pour socket or bell full of plasticized sulfur or hot-pour asphalt-base material to seal joint.
- For horizontal joints, dam off socket or bell with an asbestos runner against the pipe bell seal runner. Leave a pouring gate at the top. Pack clay or mud around the asbestos and pour sulfur or asphalt into the joint.

For maximum chemical resistance to alkalis, acids, salts, oils, and greases, it is essential that an appropriate resin cement be trowelled into the annular space portion coming in contact with the process stream. Any joint which would allow back-up material (sulfur, asphalt-base) to enter the joint would be unacceptable and would have to be repaired.

▶ **Equal Cost** — It is generally believed that the hot-pour back-up joint lowers over-all installed joint cost—heat of the back-up material accelerates resin cement curing and permits the completed joint to be placed in service sooner. However, field installation experience shows that the hot-pour back-up and the all-resin joint installations are equal in cost.

Since most resin cements used with chemical stoneware piping are brittle, cracks might develop during curing or as a result of thermal shock. This is true of furan, polyester, epoxy motar cements.

Such cracks permit contact of the process solution with hot-pour back-up material. To avoid this, an all-resin joint was designed for an application which required the ultimate in low contamination (see sketch).

The following technique is recommended:

- Sandblast bell and spigot

What Cement Do You Use?

Most of the modern organic cements now used in stoneware construction consist of two packages which are combined just before use. One package contains the cement resin, the other package contains a catalyst or curing agent. Important cements are:

Phenolic Cements: Good for Acids

These are based on phenol-formaldehyde condensation products, and have excellent solvent resistance.

Resistance to caustics is not good, although phenolics can be used for mild alkalis at room temperatures. Strong alkalis attack the hydroxyl group in the cured resin (cured with alkaline catalyst). Also, strong oxidizing acids attack phenolic cements, but resistance to 60-90% sulfuric and dilute nitric is better than furans.

While low-cost materials, phenolics are being displaced in this country by other, more versatile, mortars.

Furan Cements: Low Cost, Good Resistance

A popular cement combining good chemical resistance with low cost. Liquid furan resins are mixed with an acid catalyst to make the cement or mortar.

Generally, furans resist nonoxidizing alkalis, acids and solvents at temperatures up to 370F. Silica and asbestos fillers should not be used when processing strong alkalis, hydrofluoric or fluorosilic acids (use carbon fillers).

Polyester Cements: For Acids, Alkalis

This relatively new two-package cement is based on unsaturated polyester resins. Cements are resistant to nonoxidizing acids, acid or neutral salts and polar solvents in most concentrations.

With a silica filler, they are not recommended for service involving hydrofluoric or fluorosilic acids.

Resistance to dilute nitric and chromic acids is excellent at room temperatures. While resistance to hot acids is generally good, polyesters should not be used above 200 F. in continuous service.

Alkali resistance is not good—cements are attacked by solutions with a pH above 11.

Epoxy Cements: Good But Expensive

Epoxy-based cements have very good resistance to salt solutions and nonoxidizing acids. Solvent resistance is good, but not as good as phenolics. Resistance to alkalis is better than phenolics or polyesters.

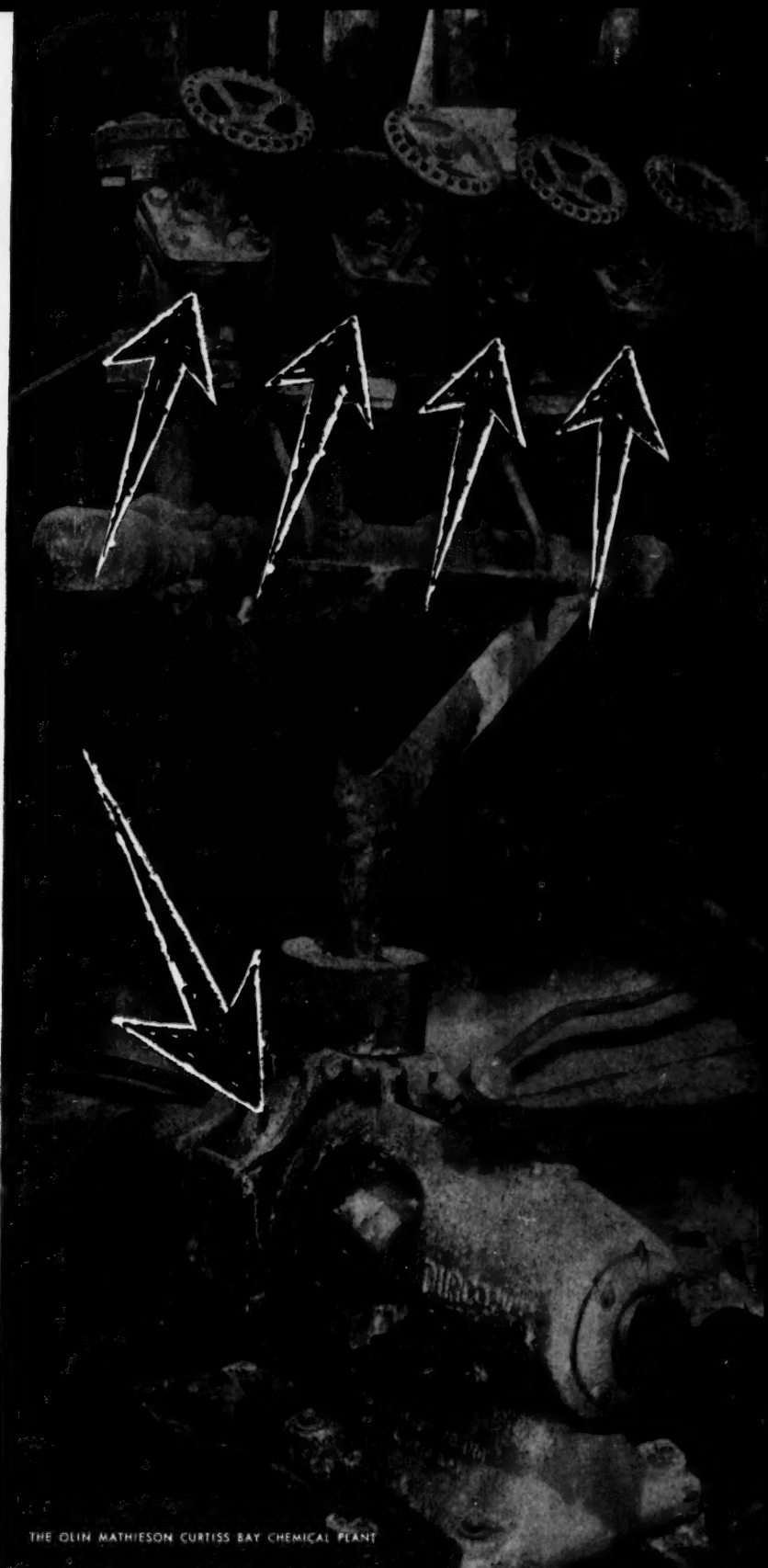
Epoxy cements should not be used against strong oxidizing acids such as nitric or concentrated sulfuric.

Adhesion to most surfaces is excellent, perhaps best of the organic cements. But epoxies are high-cost materials.

Through the years, for less maintenance, longer service life, and dependable performance, Olin Mathieson Chemical Corp. has used

DURCO VALVES
and
DURCOPUMPS

Illustrated are some of the Durcopumps and Durco valves of Duriron and Durimet 20 that Olin Mathieson are using in one of the world's largest sulfuric acid plants. Durco equipment is available in fourteen standard alloys and non-metallics to meet virtually every corrosive condition. If you have a severe corrosion problem, bring it to Durco . . . most people do.



THE OLIN MATHIESON CURTISS BAY CHEMICAL PLANT

pipe ends to remove the slick borax glaze. This gives maximum adhesion. Also, completely remove all grease and foreign matter and thoroughly dry the pipe.

• Trowel the appropriate resin cement required for specific process conditions (furan, polyester, or epoxy) into the bell of the pipe and onto the end of the spigot.

• Shove spigot end of connecting pipe into the resin cement until it seats centered against the bottom of the socket or bell.

• Tightly tamp multiple rings of resin-impregnated 95% white asbestos rope on top of the cement until the annular space is filled within an inch of the end of the bell. Fill balance with resin cement only.

• Clean inside of joined sections by swabbing to remove excess mortar after the joint is completed to remove icicles, hangers, and provide a smooth interior.

• After 24 hr., hydrostatically test the joint (10 ft. maximum head) to check for leaks. If leaks develop, it is necessary to sandblast mortar out of the annular space and repack as outlined above to obtain leak-tight joints.

Installed cost, using the above procedure, was not more than the standard installation using hot-pour back-up.

B. C. HAWORTH is a materials engineer in the engineering service division of du Pont. He's been in corrosion engineering work with du Pont for 8 yr. He has a B.S. in metallurgical engineering from Lehigh and worked for General Electric and Haynes Stellite as a metallurgist, before joining du Pont. Mr. Haworth is a member of AWS and NACE.

J. M. STOKELY has been with du Pont's engineering department for 18 yr. He started with the company as a rodman and is now assistant project manager at the Old Hickory, Tenn., project. Actually, he's worked on 14 multi-million dollar du Pont construction jobs, including a 2 yr. project in Argentina. Mr. Stokely is a member of Amer. Soc. of Civil Eng.

► **Keep Pipe Rigid**—All buried piping was placed on a 2-in. thick concrete working pad with the bells supported in wood saddles to maintain proper alignment and to prevent joint failure due to settlement during curing of the resin cements. This is standard practice whenever resin cements are used with chemical stoneware pipe producing rigid joints. As an added precaution, we wire all piping to the working pad and then encase in reinforced concrete to maintain rigidity.

The all-resin joint system has been in operation for well over a year and a half, and has shown no indication of leakage. Because of the success and comparable cost of this method versus conventional methods, a number of du Pont installations employing the new technique have been made.

Big Improvements In Molybdenum

The day may not be too far off when you can buy low-cost molybdenum-alloy chemical equipment capable of handling temperatures of 2,000 F.

A recent flurry of activity gives some idea of what the future holds (also see *Chem Eng.*, Mar. 1957, p. 298).

Climax Molybdenum Co. of America has recently reduced prices on moly forging billets from $9.85/lb. to $8.00/lb. This reduction doesn't take moly out of the "exotic" category, but it's a step in the right direction.

Also, Climax now makes a 70-30 molybdenum-tungsten alloy for temperatures in the 2,000 F. range. Tungsten boosts the melting point from 4,750 F. (for moly) to 5,100 F. Sintered moly-tungsten alloys have been available, but this is the first alloy made commercially by arc-cast methods. A big potential market: equipment handling molten metals.

Actually, there are two methods for making molybdenum: powder metallurgy and arc-cast or melting.

First technique makes ingots by sintering compressed powder. It's limited to small ingots—maximum of about 500 lb. The other makes large ingots via a vacuum melting procedure in an alternating current arc.

And the powder metallurgy people have been busy. General Electric has developed ductile molybdenum sheets that can be worked at room temperatures. Until now producers had to work at 1,000 F. to form molybdenum into various shapes. GE's new sheet has room-temperature ductility five times that of ordinary sintered moly. It can be bent 90 to 180° without failing, while ordinary sheet will fail at 20°.

This new development opens the way for punching, deep-drawing operations and production of complex pieces of equipment.

This is not to say that all moly's problems have been solved. One major disadvantage still remains—despite a high melting point, moly oxidizes rapidly above 1,000 F. All sorts of coatings have been tried—ceramics and cermets, claddings, metal sprays, electroplating, without too much success. But many experts look to a recent chromizing technique as a possible answer. This is a chromium diffusion coating (Chromalloy Corp.): gaseous chromium diffuses into the metal, forms a metallurgical bond. The developer of this process claims molybdenum so treated can be used for temperatures in excess of 2,000F. It remains to be seen whether such a process can be justified on a cost basis. Chromium diffusion is expensive.

Commercially - pure molybdenum is resistant to most non-oxidizing chemicals, including caustics, hydrochloric, sulfuric and hydrofluoric acids. It's also good against many molten metals (potassium, sodium, bismuth, lithium, magnesium, zinc, mercury).

However, it is attacked by oxidizing agents such as nitric acid, aqua regia and molten alkali salts. Also water vapor, sulfur dioxide, nitric oxides oxidize molybdenum at high temperatures. The new chromium-diffusion process might improve resistance of molybdenum to many oxidizing materials, since it evidently provides a protective layer resistant to oxidation.

USCOLITE PLASTIC PIPE

CONFUSED ABOUT PLASTIC PIPE?

(MOST EVERYONE IS)

Here's your guide:

U. S. Uscolite® CP acrylonitrile-butadiene-styrene copolymer (ABS-I) pipe is best where maximum resistance to impact is demanded. It will safely handle most chemicals of industrial importance at working temperatures up to 170°F. This is the major plastic pipe used by chemical processing industries.

U. S. Uscolite RV polyvinyl chloride (PVC-I) pipe is best for extremely active oxidizing agents such as strong sulphuric, nitric and chromic acids. This unplasticized, unmodified Type I PVC has high impact strength and handles temperatures up to 140°F, far in excess of normal requirements.

Uscolite HT (ABS-II) pipe is a new addition to the resin-rubber compounds. HT stands for exceptionally High Tensile qualities, plus much better retention of physical properties at High Temperatures.

These types of Uscolite Pipe cover all requirements, not only because they are virtually immune to internal and external corrosion, but they are non-contaminating, odorless, impart no taste or discoloration. Because of these qualities they are approved by the National Sanitation Foundation for carrying drinking water. The use of Uscolite results in a saving of appreciable dollars in installation costs and reduction in man-hours. The skills to install metal pipe are not required to install Uscolite. Assembly can be accomplished in half the time. *Not one foot of Uscolite Pipe has ever failed in service when used in accordance with our recommendations.*

A fourth pipe, *UscoFlow HT (ABS-II)* is a black utility pipe, especially suitable where low first costs are a factor. It's a blend of styrene-base resin and synthetic rubber for good impact resistance and high tensile strength. UscoFlow is the ideal answer to builders and large developers who are seeking long-lived, maintenance-free pipe for plumbing.

We invite detailed inquiries or call your "U. S." plastics distributor. He has the *largest* line of plastic pipe and fittings, plus an experienced background to settle any and all questions about which pipe to use.

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WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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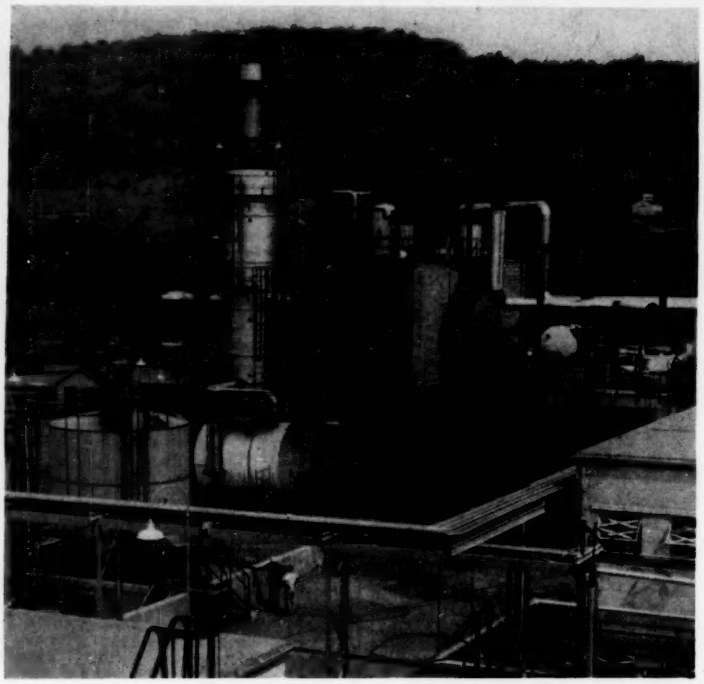
FIRMS IN THE NEWS

J. A. KING

NEW FACILITIES



Cyanamid's new Maleic Anhydride Production Facility

American Cyanamid Co. has nearly completed construction of this maleic-anhydride plant at Bridgeville, Pa. When completed, team of conversion and purification systems will have a capacity of 2,000 tons/yr. Cyanamid's Plastics and Resins Div. will operate the new facility, will market the maleic anhydride for use in paint, varnish, laminates and agricultural chemicals.

Olin Mathieson Chemical Corp. reveals details of a $30-million expansion program. OM will build new facilities at Brandenburg, Ky. for production of glycerine, epichlorohydrin, propylene oxide, propylene, glycol ethers, ethylene dichloride and polypropylene glycol. Plans also include new sulfamic-acid capacity at Juliet, Ill. and expanded chlorine output at Niagara Falls, N. Y.

Vitro Engineering Co. will design and engineer a $4.3-million nuclear-fuel reprocessing plant for the U. S. AEC at the Hanford Works. New plant will reprocess from 50-150 tons/yr. of irradiated fuel of all designs and forms up to 5% U-235.

Pacific Carbide and Alloys Co. is constructing a 5-million-lb/yr. vinyl acetate monomer plant in Portland, Ore. This first west-coast VA-monomer plant will satisfy rising demands by VA-polymer pro-

Service for PETRO-CHEMICALS from... ALLIS-CHALMERS

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brings service to any branch plant

Your branch plants — no matter where they are located — are only a phone call away from Allis-Chalmers service.

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- **79 Local Offices** — covering every industrial area in the country.
- **Field and Erection Personnel** — located strategically for 'round-the-clock' duty.
- **Certified Service Shops** — a vast network to provide minutes-away service.
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Matching this service is a tremendous scope of industry-designed equipment from one source. Ask your A-C representative about the last word in product designs, all proven by research and application, all built for outstanding quality control. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Products for Petro-Chemicals: Electrical Generation, Distribution and Utilization Equipment; Pumps, Compressors, Motors and Control; Texrope Drive Equipment; Processing Machinery (mills, kilns, screens, etc.); Water Conditioning Systems, plus Materials Handling Equipment.

Texrope is an Allis-Chalmers trademark.

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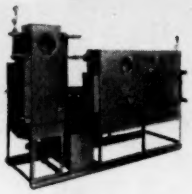

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Now you can design spaces to maintain air sterility as scientifically as temperature and humidity. Only Kathabar enables you to calculate bacteria gain and maintain design limits of 5 micro-organisms per 10 cu. ft. or less, continuously.

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Permanently stop condensation on walls, floors, products. Dry up exposed water (bacteria breeding ground) no matter what your dry bulb. Results proved (you check) almost anywhere: instruments... pharmaceuticals...fertilizers... photo film...plastics. Name your required conditions (grains/pound and dry bulb) for process, storage, testing: Kathabar systems deliver.

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Surface

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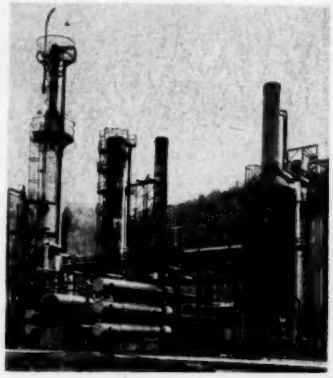
FIRMS . . .

ducers such as Reichhold, Borden and Specialty Resins.

Humble Oil & Refining Co. has placed on stream its new 31,000-bbl./day phenol plant in Baytown, Tex. New facility employs centrifugal extractors instead of the conventional gravity separation towers.

Dow Chemical of Canada, Ltd. is constructing a phenol plant to use its own new route to phenol from toluene. Dow declines to reveal location or capacity of new facility.



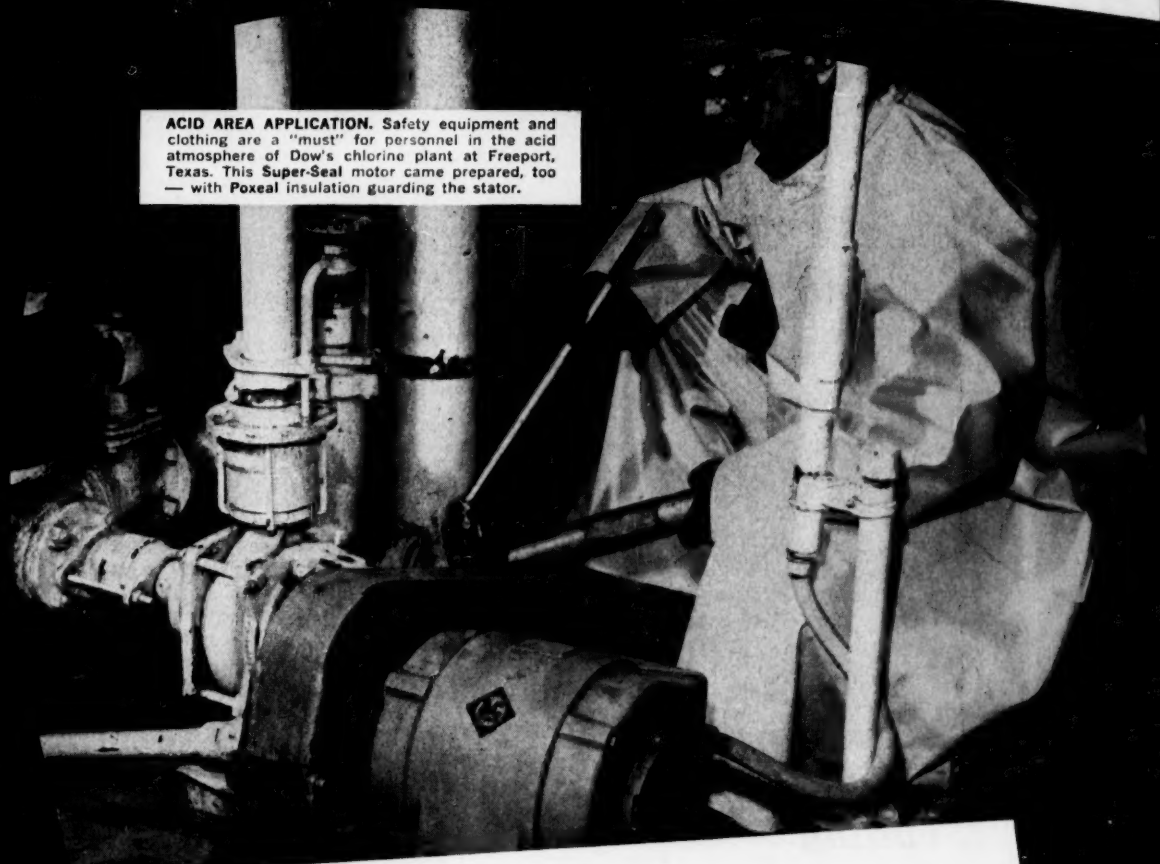
United Refining Co. has just placed on stream its new 15,000-bbl./day hydrogen treating unit at its Warren, Pa., refinery. Shown above are the Unifining unit's stripping tower, horizontal flash drum, heat exchanger, vertical heater, and reactor.

Union Carbide Nuclear Co. announces plans for expansion of its tungsten refinery at Bishop, Calif. New facilities, to be completed by the end of the year, will include capacity to produce high-purity ammonium paratungstate.

Spencer Chemical Co. reveals plans for construction of a 36-million cu.-ft./yr.-argon plant in Vicksburg, Miss. Spencer will produce argon gas from an enriched waste gas stream from an ammonia plant, will supply the argon to the electronics and missile industries.

SCOPE in MOTOR DEVELOPMENT from . . .

ALLIS-CHALMERS



ACID AREA APPLICATION. Safety equipment and clothing are a "must" for personnel in the acid atmosphere of Dow's chlorine plant at Freeport, Texas. This **Super-Seal** motor came prepared, too — with **Poxeal** insulation guarding the stator.

2-YEAR ACID TEST!

Open motor beats enclosed type at its own game

In a tough acid pump installation, Dow Chemical's Texas Division experienced no end of motor troubles. It seemed nothing could stand up in that humid, corrosive atmosphere. Reports Dow: "Even with totally enclosed motors, winding failures were frequent." And, they might have added, expensive.

Then came *Super-Seal* motors — Allis-Chalmers open-type motors with amazing *Poxeal* insulation. A durable case of epoxy-resin encloses the winding end turns and slot portions of the stator . . . the most complete protection ever developed. Result? The *Super-Seal* motor, after two years of continuous operation in the acid area, is as good as ever. So good, in fact, that Dow has ordered 150 *Super-Seal* motors for a new chemical plant at Freeport, Texas.

Isn't it time to revaluate *your* motor standards? There's a good chance that costly enclosed motors are no longer needed. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Super-Seal and *Poxeal* are Allis-Chalmers trademarks.

A-1036-C&P

A-C ALLIS-CHALMERS

SUPER SEAL

FACTS You Should Know . . .

about the DIFFERENCE in Stainless Steel Tubing --

Both photographs above show the microstructure of the weld and base metal of Type 304 stainless steel tubes. Photograph A reveals accelerated corrosion of the weld metal due to the presence of delta-ferrite. This tube was manufactured by welding, swaging and annealing, which is an insufficient amount of cold work to produce a high quality, uniformly corrosion-resistant welded tube.

Photograph B shows a typical tube supplied by Wallingford Steel. This tube was produced by the welding and cold drawing process, then inspected with a Magne Gauge to insure no ferrite was present in the weld metal. *Processed and inspected in this manner, Wallingford Cold Drawn Tube is guaranteed to show no preferential attack in weld area.*

All Wallingford welded stainless steel tubing is cold drawn and inspected by Magne Gauge. *Can your suppliers say this about the stainless steel tubing they produce?* Wallingford's manufacturing techniques and quality control checks assure top quality — *yet cost you no more.* Why not purchase *your* tubing where *tonnage is produced on a laboratory basis?*

THE WALLINGFORD STEEL CO.

Progress in Metals for over 37 Years

WALLINGFORD, CONN., U.S.A.

COLD ROLLED STRIP: Super Metals, Stainless, Alloy
WELDED TUBES AND PIPE: Super Metals, Stainless, Alloy

FIRMS . . .

Stauffer Chemical Co. is constructing a new methane purification unit at its LeMoyne, Ala. plant. New unit being designed and constructed by TRECO, a division of Vitro Corp. of America is shipping the prefabricated plant on skid mounts from Tulsa, Okla. to LeMoyne, Ala.

Tidewater Oil Co. and **Skelly Oil Co.** are negotiating, with a view to possible merger. Executives from both companies feel that the merger would result in a better balance between crude requirements and supply.

Armour Chemical Industries, Ltd. has merged with Hess Products, Ltd, of London, England. Hess is well known as a producer of cationic nitrogen derivatives of fatty acids.

Nuclear-Chicago Corp. announces the establishment of a new division to service industrial users of radioisotopes. New division will offer application-engineering and product-engineering services related to isotope use.

Reichhold Chemicals, Inc., announces its intent to purchase the Varcum Chemical Corp. of Niagara Falls, N. Y. Varcum manufactures a wide range of liquid, powdered and solid phenol-formaldehyde resins.

Yuba Consolidated Industries has purchased Arrow Industrial Manufacturing Co. of Tulsa, Okla., and Nichols Construction Co. of Baton Rouge, La. Aimco will continue to manufacture air-cooled heat exchangers and Nichols will continue to market its maintenance, engineering and construction services.

SCOPE of PUMP DEVELOPMENT from... **ALLIS-CHALMERS**

POXEAL insulation system of *Super-Seal* motors provides a stator completely impervious to contaminating elements. Result: A close-coupled pump with an open-type motor that can "take" the toughest atmospheres.

You can save up to 20% on close-coupled pumps

Capacities to 2500 gpm, heads to 550 ft.

Now from Allis-Chalmers: close-coupled pump units powered by *Super-Seal* motors with *Poxeal* insulation!

You can save up to 20% by specifying these units. Reason: Open-type *Super-Seal* motors may be used in many areas previously requiring more costly enclosed motors.

In addition to moisture-defying *Super-Seal* motors, these pump units offer heavy-duty construction, easily replaceable wearing rings, balanced impellers, plus other quality pump features. It all adds up to a cost-saving pumping package for a wide variety of installations.

Contact your A-C representative or distributor for coordinated pumping equipment — pumps, motors, control and drive. *Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.*

Plan to stay ahead... MODERNIZE!

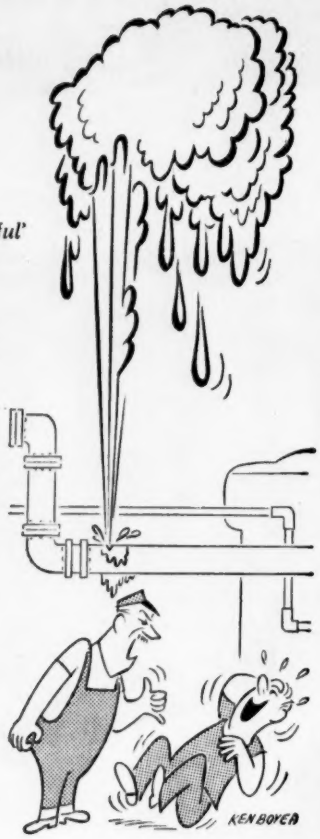
Super-Seal and *Poxeal* are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

A-5883-C

Life in these excited states...

"Stop saying 'There goes Old Faithful' and get it fixed!"



What to do when corrosion sends costs sky high

No one can afford ruined equipment, endless repairs, and plant shut-downs caused by corrosion. And you *shouldn't* afford *over*-design and too-fancy equipment. Ace takes you right down the middle . . . a wide choice of chemical-resistant pipe, pumps, valves, tanks, etc. Best for the money anywhere . . . backed by 108 years' experience.

Best non-metallic pipe anywhere for *hot* chemicals to 275°F. Also handles tough organics. Rigid, tough nitrile. Pipe and fittings to 8". *Bul. 96A.*

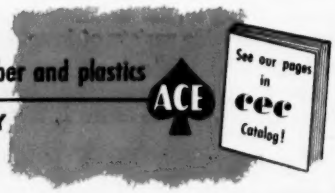
1001 uses. Non-toxic, odorless, tasteless, sterilizable, flexible tubing. Excellent for chemicals, foods, and for lab or machine lines. ⅛ to 1¼". *Bul. 66.*

Heavy Ace rubber and plastic tank linings unexcelled for alkalies, acids, bleaches, salts. Faultless seams, indestructible bond, shock and age-resistant. All shapes. *Bul. CE-53.*

Special equipment often can be machined, punched or welded of standard plastic or hard rubber sheet, rod or tubing. Write for details today.

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey



FIRMS . . .

Socony Mobile Oil Co. is consolidating its operations from coast to coast, into a single unit: Mobile Oil Co. Transfer will result in central management of: Magnolia Petroleum Co. in the Southwest, General Petroleum Corporation on the west coast and Mobile Producing Co. in the North Central and Rocky Mountain States.

American Petrofina announced its acquisition of Colonial Petroleum Co.'s marketing properties. Colonial Oil Products Co. of Des Moines, Iowa will operate the marketing properties for American Petrofina.

OVERSEAS BRIEFS

Philippines: Royal Dutch-Shell companies have sold one quarter of their Filipino holdings to a group of native investors. Resulting from the negotiations are plans for construction of a new 25,000-bbl./day oil refinery.

Japan: Mitsui Petrochemical Industries, Ltd., Iwakuni City, is completing expansions of its terephthalic acid, ethylene glycol and ethylene oxide plants. Present plant, in operation about a year, has been in full operation since it went on stream.

Germany: The Northwest German Group of Public Power has contracted with two German firms for construction of a 15,000-kw., high-temperature, nuclear power reactor. Construction, to begin next spring, will be completed in three years.

India: Kaiser Aluminum & Chemical Corp. and the Birla Interests in India have completed plans for construction of an aluminum plant, to cost $30-million. Kaiser Engi-

neers, div. of Henry J. Kaiser Co., will build the plant in India, to be completed by 1962.

Egypt's Transport & Engineering Co. of Cairo has started expansion of its rubber and tire plant at Smouha, Alexandria. TRENCO will increase its output from 180,000 to 300,000 tires/yr.

Germany: Chemische Werke Huels reveals styrene, acetic acid, ethylene oxide, propylene oxide and polystyrene expansions. Total capital investments last year were $20.6 million.

Italy: American Cyanamid Co. announces plans to form Cyanamid Italia, SpA. to manufacture pharmaceuticals and chemicals. Included in the plans is the construction of a $13-million manufacturing facility.

Australia: B. F. Goodrich Co. discloses plans for construction of a $4.5-million plant to produce Geon vinyl plastics; B. F. Goodrich Chemical Co. will operate the new plant.

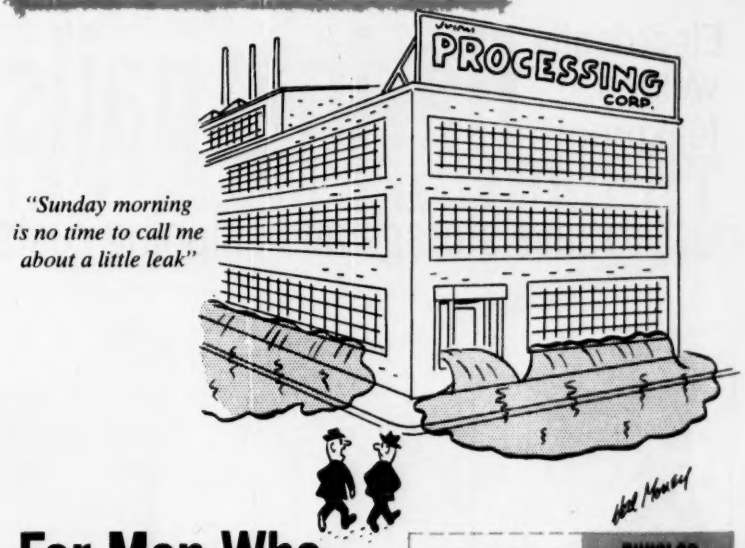
India: Montecatini's subsidiary, Aziende Colori Nazionali Affine, is cooperating with Indian Dyestuffs Industries, Ltd., to establish dyestuff production facilities near Bombay.

NEW LINES

Gulton Industries, Inc. announces formation of an Ortholog Div. to expand the company's interest in the statistical and data-analysis fields.

Vitro Rare Metals Co., Canonsburg, Pa., has begun production of nickel chloride and nickel carbonate for electroplating operations.

Life in these excited states...



"Sunday morning is no time to call me about a little leak"

For Men Who Work 24 Hours a Day

Like the phone ringing when you're in the shower, corrosion and contamination wait for no man. Best way to confine it to normal working hours is to specify trouble-free Ace chemical-resistant equipment by American Hard Rubber Company. Best for the money anywhere... backed by 108 years of experience.

All-purpose rigid PVC. Sched. 40, 80 & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". NSF-approved. *Bul. CE-56.*

Improved design... now 12 gpm. All wetted parts acid-resistant, wear-resistant Ace hard rubber. Finest available. *Bul. CE-55.*

Flexible poly pipe, ideal for water lines, drains, underground pipe or conduit. Sizes ½ to 2", long coils, NSF-approved for drinking water. *Bul. CE-57.*

World's best chemical valves ... at moderate prices. All-plastic, rubber-lined, or all-hard-rubber. ⅛" pet cocks to 24" gate valves.

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
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Ace Road • Butler, New Jersey

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Electrically welded, leakproof **flaring pails**

nest to save storage and shipping costs

9,000 vs. 3,000

A boxcar holds 3 times as many flaring as straight-sided pails. Same 5-gal. capacity!

SINGLE ELECTRICALLY WELDED SEAM

Single seam construction

gives leakproof protection for hard-to-hold products

These pails offer greater strength and protection for liquid roofing cements, paint and petroleum products, dry or powdered materials. Ask your Continental man for details.

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Canadian Division: 790 Bay St., Toronto, Ont.
Cuban Office: Apartado #1709, Havana

CALENDAR

Technical Assn. of the Pulp and Paper Industry, 14th Paper-Plastics Conference, Edgewater Beach Hotel.
Sept. 21-23 Chicago, Ill.

Instrument Society of America, 14th annual Instrumentation-Automation Conference Amphitheatre.
Sept. 21-25 Chicago, Ill.

Industrial Nuclear Technology Conference, Morrison Hotel.
Sept. 22-24 Chicago, Ill.

American Rocket Society, conference on solid propellants, Princeton University.
Sept. 24-25 Princeton, N. J.

American Society for Quality Control, Chemical Div., annual conference, Shamrock Hilton Hotel.
Sept. 24-25 Houston, Tex.

International Union of Pure and Applied Chemistry, 20th conference.
Sept. 26-29 Munich, Germany

American Institute of Chemical Engineers, national meeting, Hotel St. Paul.
Sept. 27-30 St. Paul, Minn.

American Oil Chemists Society, fall meeting, Statler Hotel.
Sept. 28-30 Los Angeles, Calif.

American Institute of Mining, Metallurgical and Petroleum Engineers, Div. of Petroleum Engineers, fall meeting.
Oct. 4-7 Dallas, Tex.

Packaging Specifications Conference, Purdue University.
Oct. 5-6 Lafayette, Ind.

American Gas Assn., national conference, Conrad-Hilton Hotel.
Oct. 5-7 Chicago, Ill.

International Symposium on High-Temperature Technology, arranged by Stanford Research Institute.
Oct. 6-9 Asilomar, Calif.

Society of Plastics Engineers, Technical meeting: Vinyl Plastics.
Oct. 7 Cleveland, Ohio

American Vacuum Society, annual meeting, Penn Sheraton Hotel.
Oct. 7-9 Philadelphia, Pa.

American Society for Testing Materials, Pacific Area National Meeting, Sheraton-Palace Hotel.
Oct. 11-16 San Francisco, Calif.

Assn. of Agricultural Chemists, annual meeting, Shoreham Hotel.
Oct. 12-14 Washington, D. C.

Technical Assn. of the Pulp and Paper Industry, engineering conference, Penn Sheraton Hotel.
Oct. 12-15 Pittsburgh, Pa.

Western Agricultural Chemicals Assn., fall meeting, Villa Hotel.
Oct. 13-14 San Mateo, Calif.

Society of Plastics Engineers, technical conference, Ambassador Hotel.
Oct. 13-14 Los Angeles, Calif.

(*Continued on p.* 198)

3 GREAT NEW magic markers from Speedry!

SPEEDRY does it again! Three great new additions to the world's largest and most efficient line of marking, stamping, stencilling devices and inks for industry.

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Type "A" Transparent inks. Instant-dry, waterproof, permanent for any surface or material. New heavy duty replaceable nib. Available in 8 colors.

Aluminum seamless body, ⅜" cube felt nib, with pocket clip. **$1.59**

Refills 89¢ Replaceable Nibs 25¢

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Aluminum seamless body, ⅜" nylon and felt nib head, with pocket clip. **$1.89** Refills 99¢

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Type "DO" Heavy Opaque inks (lacquer base). Ball & Valve action in unbreakable, refillable squeeze bottle. For porous, dirty, rough, abrasive, grimy or oily surfaces. Now available white, black & yellow.

Filled ready-to-use. **$1.79**

Type "DO" Inks
4 oz: $1.40 8 oz: $2.50 16 oz: $4.35

The best mark on the job is made with a Speedry product. There's at least one for every job!

Send for FREE TECHNICAL BULLETINS on specific marking, stamping, stencilling problems. Write:

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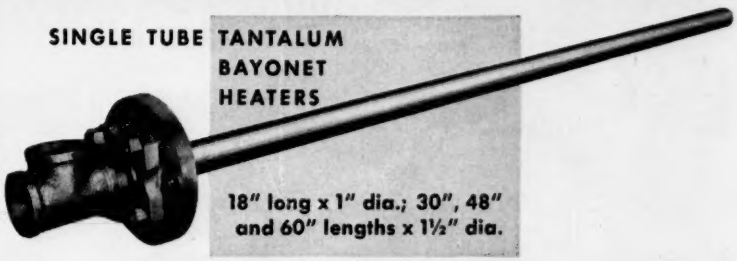
TANTALUM EQUIPMENT

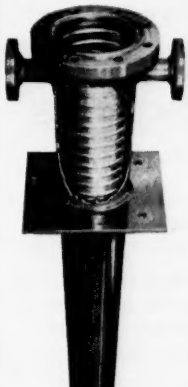
SINGLE TUBE TANTALUM BAYONET HEATERS



18" long x 1" dia.; 30", 48" and 60" lengths x 1½" dia.

THREE-TUBE TANTALUM BAYONET HEATERS

69" long
1½" diameter



TANTALUM TAPERED TUBE CONDENSERS
3" x 2" x 36" and 6" x 2" x 60"

Here's another big step in Fansteel's stock expansion program to better serve the chemical industry. These and other Fansteel tantalum products—such as heat exchangers and coil and "U" type heaters—are gaining universal acceptance wherever chemical processing equipment must be contamination-free, acid- and corrosion-proof. Fansteel is the only supplier of tantalum equipment who performs the entire job—produces the metal from ore, engineers the application, designs and builds the equipment.

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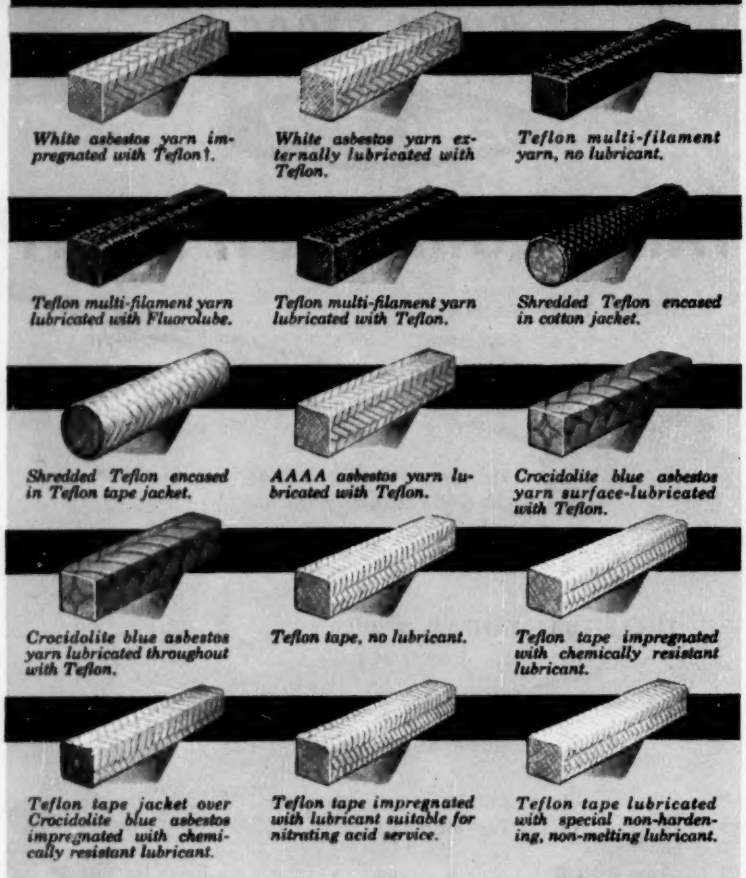
Address inquiries to Equipment Department, Metals and Fabrication Division

G593A

FANSTEEL METALLURGICAL CORPORATION North Chicago, Ill., U.S.A.

15 SPECIFIC PACKINGS FOR ALL CORROSIVE SERVICES



White asbestos yarn impregnated with Teflon†.

White asbestos yarn externally lubricated with Teflon.

Teflon multi-filament yarn, no lubricant.

Teflon multi-filament yarn lubricated with Fluorolube.

Teflon multi-filament yarn lubricated with Teflon.

Shredded Teflon encased in cotton jacket.

Shredded Teflon encased in Teflon tape jacket.

AAAA asbestos yarn lubricated with Teflon.

Crocidolite blue asbestos yarn surface-lubricated with Teflon.

Crocidolite blue asbestos yarn lubricated throughout with Teflon.

Teflon tape, no lubricant.

Teflon tape impregnated with chemically resistant lubricant.

Teflon tape jacket over Crocidolite blue asbestos impregnated with chemically resistant lubricant.

Teflon tape impregnated with lubricant suitable for nitrating acid service.

Teflon tape lubricated with special non-hardening, non-melting lubricant.

John Crane CHEMLON *BRAIDED PACKINGS

Specific service conditions are always best handled with a packing designed for the purpose. This is especially true when it comes to the hard-to-handle liquids in the chemical, petrochemical and refinery industries.

For this reason John Crane has developed 15 individual field-proved types of Chemlon Braided Packings. Within this line there is a type and style that will meet any combination of service conditions and requirements.

1. All known industrial acids, alkalis or solvents.
2. Temperatures from −120°F to +600°F.
3. High or low shaft speeds, also valve stems.
4. Longer packing life due to lower coefficient of friction and non-raveling construction.

Send in your service condition and we will recommend a Chemlon Braided Packing best suited to your application. Request Bulletin P-325.

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In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

†*T. M. for DuPont Teflon* *T. M. for the Best in DuPont Teflon

John Crane MECHANICAL PACKINGS SHAFT SEALS TEFLON PRODUCTS LAPPING MACHINES THREAD COMPOUNDS

CRANE PACKING COMPANY

CALENDAR . . .

Natural Gasoline Assn. of America, southern meeting, Carlton Hotel.
Oct. 16 Tyler, Tex.

American Production and Inventory Control Society, annual technical conference and exhibit, Hotel New Yorker.
Oct. 16-17 New York, N. Y.

International Fair of the Plastics Industry, Europe Hall.
Oct. 17-25 Dusseldorf, Germany

American Coke & Coal Chemicals Inst., annual meeting, Greenbrier.
Oct. 19-20 White Sulfur Sp., W. Va.

American Standards Assn., national conference, Sheraton-Cadillac Hotel.
Oct. 20-22 Detroit, Mich.

National Agricultural Chemicals Assn., national meeting, Sheraton Hotel.
Oct. 21-23 French Lick, Ind.

National Lubricating Grease Institute, annual meeting, Roosevelt Hotel.
Oct. 26-28 New Orleans, La.

Independent Petroleum Assn. of America, annual meeting, Statler-Hilton Hotel.
Oct. 26-27 Dallas, Tex.

American Institute of Chemical Engineers, New York Section, annual symposium, New Yorker Hotel.
Oct. 27 New York, N. Y.

Canadian Chemical Specialties Manufacturers Assn., annual meeting and convention, Royal York Hotel.
Nov. 2-4 Toronto, Ont.

American Society for Metals, annual exposition and congress, International Amphitheatre.
Nov. 2-6 Chicago, Ill.

American Nuclear Society, national meeting, Sheraton Park Hotel.
Nov. 4-6 Washington, D. C.

Technical Assn. of the Pulp and Paper Industry, Alkaline Paper Conference, Robert Meyer Hotel.
Nov. 4-6 Jacksonville, Fla.

Eighth Annual Instrumentation Conference, Louisiana Polytechnic Institute.
Nov. 5-6 Rushton, La.

International Rubber Conference, sponsored by A.S.T.M., A.C.S., and A.S.M.E., Shoreham Hotel.
Nov. 8-13 Washington, D. C.

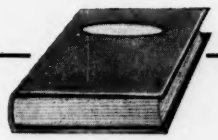
National Academy of Sciences-National Research Council, construction conference, Shoreham Hotel.
Nov. 16-19 Washington, D. C.

National Assn. of Corrosion Engineers, annual General Florida Conference, Corrosion Short Course.
Nov. 16-20 Miami, Fla

Fifth International Automation Congress and Exposition, Trade Show Building.
Nov. 16-20 New York, N. Y.

Society of Plastics Engineers, Technical conference on Plastics in packaging.
Nov. 19 San Francisco, Calif.

National Council for Stream Improvement, industrial-waste conference, Edgewater Beach Hotel.
Dec. 1-2 Chicago, Ill.



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Stokes Series H Microvac Pumps deliver top vacuum pumping value per dollar. They are designed by vacuum specialists . . . incorporate features based on actual operating requirements, to meet *your* needs. And Stokes vacuum pumps are built with care by skilled personnel to assure long, dependable operation.

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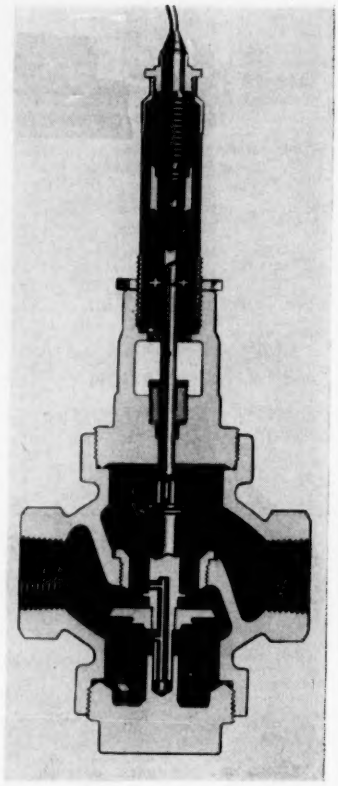
F. J. STOKES CORPORATION
5500 Tabor Road
Philadelphia 20, Pa.

STOKES

NEW EQUIPMENT . . .

(*Continued from p.* 102)

rod bearings, full pressure lubrication, and fin-and-tube scavenging air intercooler.—**Clark Bros. Co., Olean, N. Y.** **102E**



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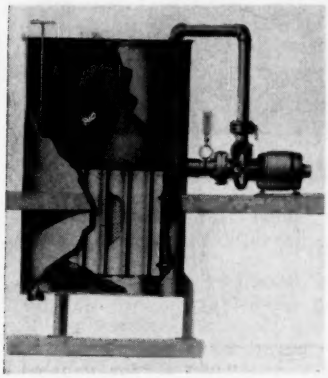
Sensing elements are fully interchangeable.

Designated as Class M for heating service and Class MR (reverse acting) for cooling service, new temperature regulators are available in ¾- and 1-in. body sizes. One feature, unique balancing bellows, results in smooth functioning at inlet pressures and pressure drops to 100 psi. Another feature is a self-aligning, single-seated, tight-closing main valve that is guided throughout its entire stroke.

Liquid-filled thermo-elements sense the variations in temperature. These elements are fully interchangeable to eliminate

messy vapor-filling maintenance requirements. A turn of a knurled adjusting sleeve sets desired temperature.

A large variety of thermoelements with various ranges, spans and bulb materials is available. Body materials of construction are cast iron or bronze.—**Leslie Co., Lyndhurst, N. J.** 200A



Diatomaceous Filter

Cleans large volumes of water. Vacuum operation.

Marketed as a completely packaged unit, the new Neptune vacuum diatomaceous filter requires no skilled operator, poses no pressure-vessel problems and is completely accessible. Available in a wide range of sizes, the units will filter up to 525,000 gal. of water in an 8-hr. period. Filtration rate is 2 gpm./sq. ft. Multiple installations can handle larger flows.—**Neptune Filter Co., Cranston, R. I.** 201A

Recorder-Controller

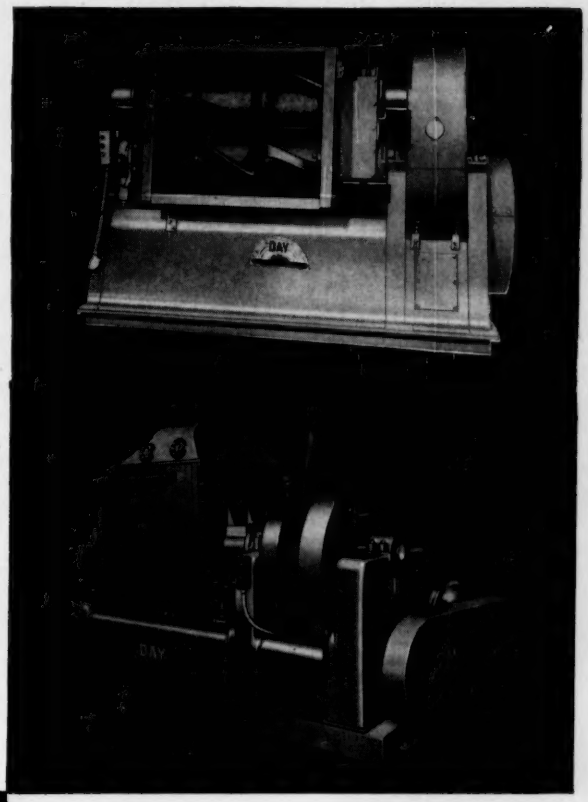
Has 24 points. Can operate with 48 thermocouples.

Daystrom, Inc., will introduce a new recorder-controller at the upcoming ISA show. The new instrument is capable of replacing up to six individual recording-controlling units.

Another feature is the ability to operate from either one or two separate thermocouples for

DAY IMPERIAL

DAY MOGUL



DAY

double arm mixers give thorough dispersion dependable operation fast production

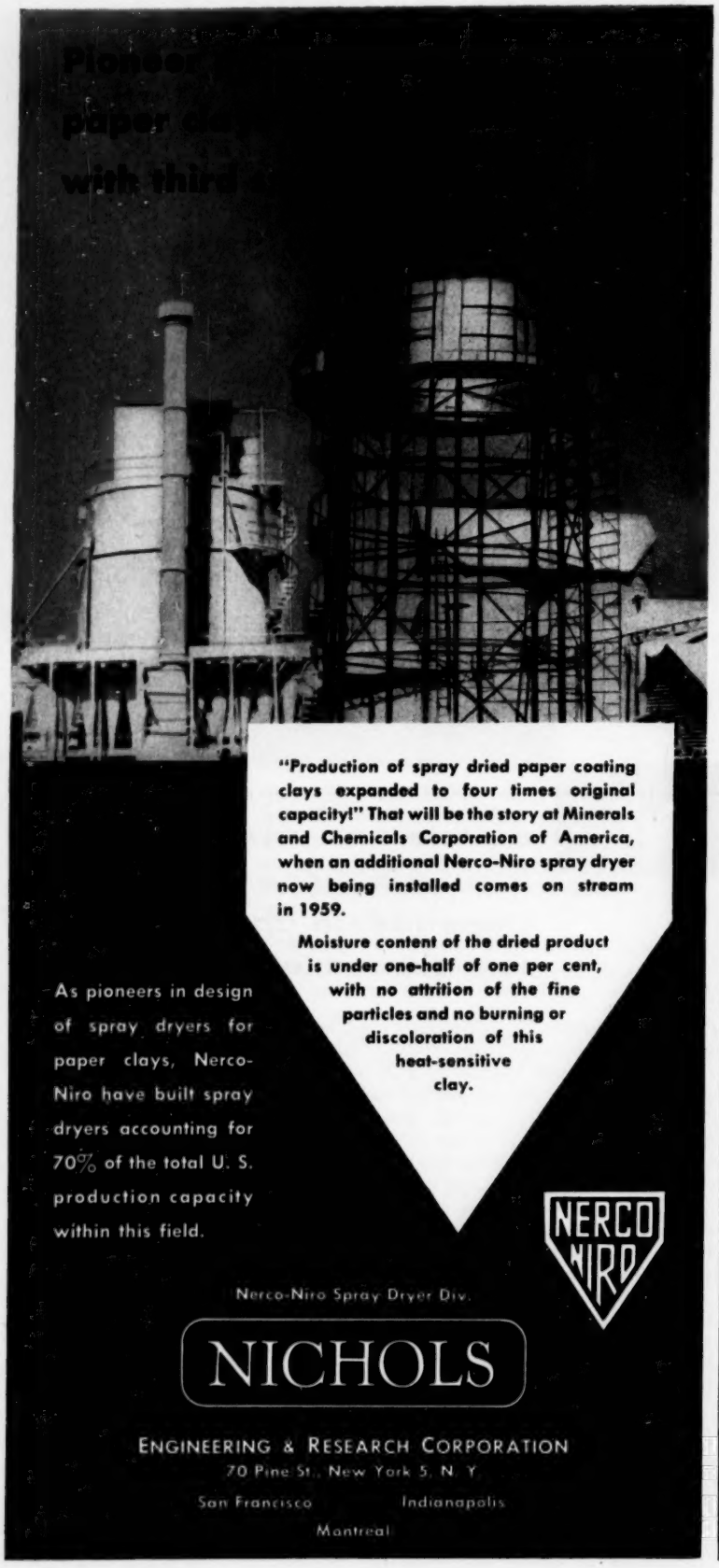
DAY IMPERIAL mixers meet every requirement for heavy duty kneading and mixing, and are the result of sound engineering, superior design and superior construction. Counter rotating agitators with 3 to 2 ratio insure thorough mixing and shearing action. Air seal stuffing boxes protect your product from contamination, and guard the heavy duty bearings from damage by abrasive mixtures. Everything about a DAY mixer is heavy, rigid and built for long service. In 35, 50, 100, 150 gal. working capacities—plain or jacketed tanks, tilting or non-tilting.

DAY MOGUL mixers are the "big boys" in our line. Their effortless mixing of extra heavy materials, like rocket fuel, flushed colors, pastes, putties, furnace cements, etc., means speedy, economical production. They have all the design features of the Imperial and are available in 2½, 5, 100, 150, 200, 300, 600 gal. working capacities.

The popularity of DAY mixers is proven by the high favor they enjoy in hundreds of plants in many industries. They are attractively priced and require a minimum of operation and maintenance expense. Make DAY *your* one source for all your process equipment requirements. New illustrated Bulletins on complete line of mixing, blending, milling, sifting equipment FREE on request.

Division of Cleveland Automatic Machine Company

4926 BEECH STREET, CINCINNATI 12, OHIO


"Production of spray dried paper coating clays expanded to four times original capacity!" That will be the story at Minerals and Chemicals Corporation of America, when an additional Nerco-Niro spray dryer now being installed comes on stream in 1959.
Moisture content of the dried product is under one-half of one per cent, with no attrition of the fine particles and no burning or discoloration of this heat-sensitive clay.
As pioneers in design of spray dryers for paper clays, Nerco-Niro have built spray dryers accounting for 70% of the total U. S. production capacity within this field.
NERCO NIRO
Nerco-Niro Spray Dryer Div.
NICHOLS
ENGINEERING & RESEARCH CORPORATION
70 Pine St., New York 5, N. Y.
San Francisco
Indianapolis
Montreal

each of the 24 recording points. Use of dual inputs provides positive protection against failure of either half of the system. Both on-off and proportional electric control are available.—**Daystrom-Weston Sales Div., Newark, N. J.** **201B**

Plasma Generator

Ideal for flame-spraying investigations. Small size.

Powered by a standard welding generator, a new, small-sized plasma generator yields temperatures ranging from 2,500 to 12,000 F. for general laboratory and production work. A typical application is development of techniques to flame-spray refractory oxides and ceramics onto other materials. The unit will fire into either vacuum or pressure chambers without major modification.

Basically, the plasma generator is a high-intensity electric-arc device consisting of a tungsten cathode designed to reduce contamination to insignificance, and a copper anode. Typical cooling media are nitrogen, argon, helium and tap water.

Size is 2¼ x 9 in.; weight is 3½ lb. Standard power level is 5 kw.—**Avco Research & Advanced Development Div., Wilmington, Mass.** **202A**

Vibration Damper

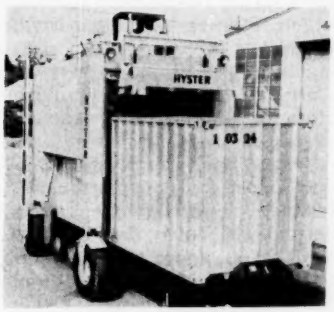
Stops damage to compression equipment, piping.

Pressure fluctuations produced by reciprocating or lobe type compressors can have serious consequences in down-

stream or upstream piping and equipment. Sympathetic vibrations in the pipelines often result in fatigue and subsequent equipment breakage. To eliminate such vibrations, a British manufacturer has introduced the Venturi Vibration Damper.

In theory, the device brings the entire gas flow up to or approaching the velocity of pressure fluctuations, and subsequently reduces the velocity to normal. This action eliminates some or all vibration.

One particular advantage of using a venturi for this purpose is that kinetic energy of the gas can be recovered almost completely, thus reducing pressure loss.—**W. C. Holmes & Co., Ltd., Turnbridge, Huddersfield, Eng.** **202B**



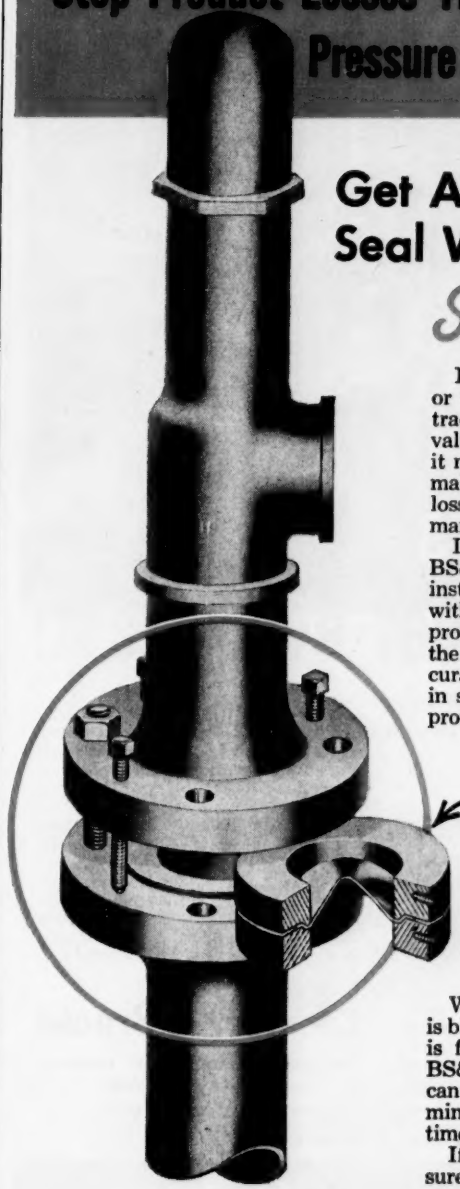
Straddle Carrier

Moves trailers from trucks to railway flatcars.

Hyster Co. has built a giant straddle carrier that can drive over a highway semitrailer, pick the detachable body off its chassis and carry the container away. Oahu Railway & Land Co. in Honolulu will use the carrier to lift trailer-sized aluminum boxes on and off trailer chassis and narrow-gage Hawaiian railway flatcars.

Standing more than 20 ft. high, over 12 ft. wide and 24 ft. long, the new vehicle has a maximum lifting capacity of 40,000 lb. An underclearance of over 14 ft. allows the special vehicle to raise containers up to 5 ft. off the ground. The truck is capable of speeds of 25 mph. — **Hyster Co., Portland, Ore.** **203A**

Stop Product Losses Through Leaking Pressure Relief Devices!



Get A "Bottle-Tight" Seal With BS&B *Safety Heads!*

Product loss in a processing or transfer system can often be traced to leaking pressure relief valves. To make matters worse, it may be extremely difficult to make repairs that will stop this loss with any degree of permanence.

In hundreds of such cases BS&B Quik-Sert Safety Heads, installed upstream and in series with the leaky relief device, have provided the perfect solution to the problem. Pressure relief accuracy is in no way impaired . . . in some cases it is actually improved.

When pressure in the system is bled back to normal, the valve is free to close as usual. The BS&B Quik-Sert Safety Head can be replaced in a matter of minutes at any later convenient time.

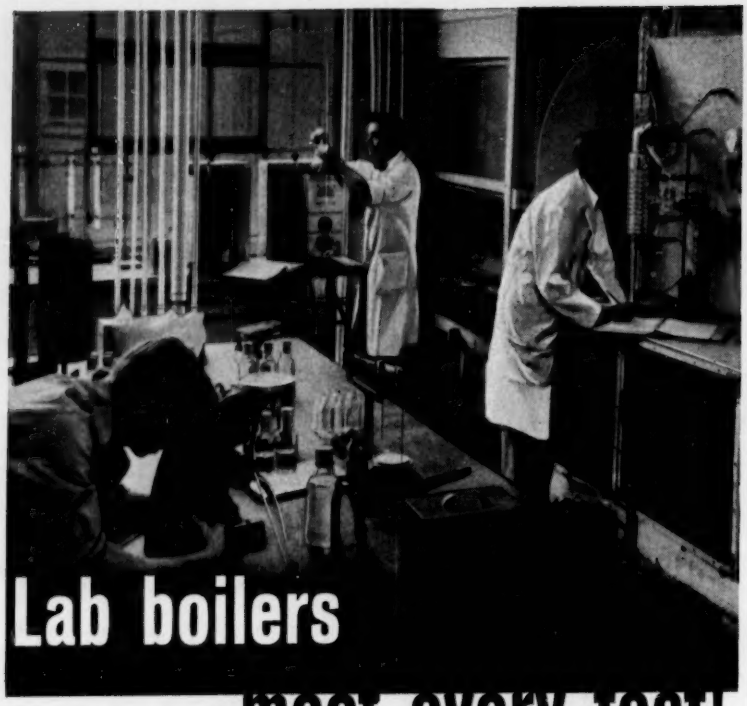
If you need a leak-tight pressure relief assembly for normal operation of your pressured systems, BS&B Safety Head specialists will gladly survey your installation and submit recommendations.

Write now for details.

BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-N9
7500 East 12th Street
Kansas City 26, Missouri
Telephone: BEnton 1-7200

BS&B — OVER 40 YEARS — ANOTHER EXAMPLE OF PRODUCT LEADERSHIP



Lab boilers meet every test!

Two Cleaver-Brooks 150-hp boilers satisfy all demands for steam at Shell Chemical Corporation's Union, New Jersey Technical Service Laboratories

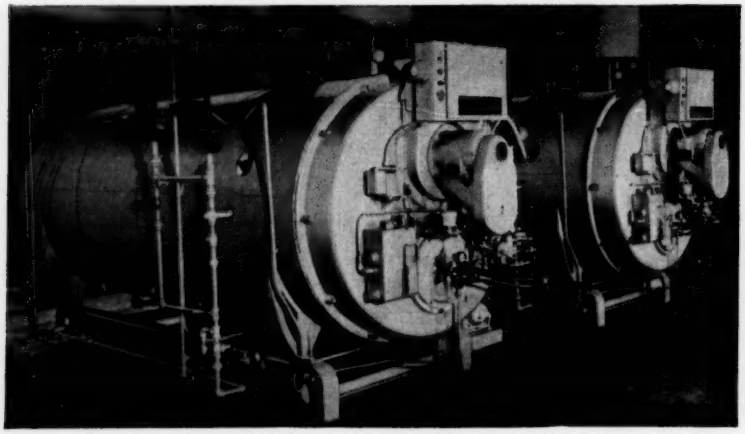
"We find Cleaver-Brooks boilers meet every test we have given them for top operating performance," reports George Baranchulk, utilities and service engineer at Shell's research building. Mr. Baranchulk goes on to say, "There is extreme versatility to our load as our requirements for heating and experimentation may run as low as 10 hp in the summer to over 140 hp in the winter. Checks we have made of CO_2 and stack temperatures indicate we are getting excellent operating efficiency — even when we vary the load over widely separated peak and low demands. These boilers have definitely lived up to every claim you have made for them."

Put Cleaver-Brooks packaged boilers to the test! They are available in sizes from 15 to 600 hp . . . for oil, for gas or for oil/gas combination firing. Contact your representative or write Cleaver-Brooks Company, Dept. K, 345 E. Keefe Ave., Milwaukee 12, Wisconsin.

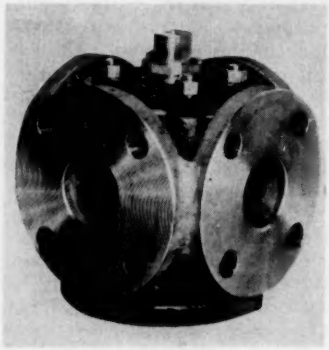
Cleaver Brooks®

ORIGINATORS AND LARGEST PRODUCER OF PACKAGED BOILERS

TESTING — Fully modulated Cleaver-Brooks boilers burning No. 6 oil supply steam for heating presses, constant temperature rooms, laboratory uses, laminating plastics and air conditioning system. Sold and serviced by Miller & Chitty Company, Union, N.J.



NEW EQUIPMENT . . .



Multiport Plug Valve

Minimizes number of valves for multiple-flow pattern.

A new line of four- and five-port, stainless steel plug valves is available in the 150-psi. class, sizes ½- through 2-in., with both flanged and screwed ends. Incorporating Teflon-resin sleeves, which require no lubrication, the valves operate without seizing in any position.

One of these valves can replace a number of standard valves in multiple-flow-pattern service. Such application reduces cost and required maintenance. For example, using bottom-port entry, flow may be directed to one of three or four horizontal ports. Or, without the bottom port, change of plug setting interconnects any two pairs of adjacent ports. In each case, wrench position indicates flow direction. — **Continental Manufacturing Co., Cincinnati, Ohio** **204A**

BRIEFS

Inclined ramp-on-wheels acts as a bridge for industrial trucks moving from ground level to elevated platforms, railroad cars, trucks and trailers. Decks are 70 in. wide. Lengths range from 25 to 36 ft. For positive traction in all weather, the riding surface is checkered steel plate. Stringers stop trucks from running off the sides.—**Elizabeth Iron Works, Elizabeth, N. J. 204B**

Mercury pressure gauges with longer ranges for either static

or differential pressures feature low cost and high accuracy. Three models cover the span between 4 and 8 psi. maximum pressure. Nonspill construction prevents loss of mercury through overpressure on mishandling of the unit. — **Meriam Instrument Co., Cleveland, Ohio.** 204C

Couplings and fittings for joining grooved-end pipe are available in two complete series: 98-1 for working pressures to 500 psi., and 98-2 for working pressures to 1,000 psi. Body material of construction is malleable iron. Tightening of two bolts that extend through the coupling halves assembles the unit. Both series meet ASTM and military specifications. — **Dresser Mfg. Div., Bradford, Pa.** 205A

Dripproof motors are available in new NEMA rerated frame sizes, from ½ hp. at 900 rpm. through 150 hp. at 3,600 rpm. —frames 182 through 445 URS. Die-cast aluminum rotor comes equipped with dual cooling fans; each rotor assembly is dynamically balanced. The motors operate on either 2- or 3-phase voltages below 600 v. in all frequencies.—**The Lima Electric Motor Co., Lima, Ohio.** 205B

Belt-conveyor pulley that increases belt life has 25% greater strength, is concentric to 0.030 in., and is free from crown welds, according to the manufacturer. True center crowns aid initial belt setting and help keep the belt centered on pulley at all times.—**Link Belt Co., Chicago, Ill.** 205C

Gas turbine engine has a rating of 1,250 hp., weighs less than 1,000 lb. and can be safely operated on a variety of liquid and gaseous fuels. Known as the Saturn, the engine also claims low fuel consumption. It occupies only 51 cu. ft., less than ⅛ the size of piston engines of similar rated horsepower.—**Solar Aircraft Co., San Diego, Cal.** 205D

NEW FAIRBANKS-MORSE

Portable Platform Scale

MODERN FUNCTIONAL STYLING

- **reads quickly and clearly under all lighting conditions!**
- **moves easily through narrower aisles!**
- **stays accurate and sensitive under roughest conditions!**

Designed for your most exacting requirements—built for years of heavy-duty use—this new Fairbanks-Morse Model 1124A Portable Platform Scale helps speed your operations through faster, more accurate weighing!

Note the big, clear beam design that promotes quicker reading—the new square weights for easier handling! Check the new concealed wheels, the compact overall width—important for fast handling in congested areas. Notice the absence of check rods, to eliminate binding. From top to bottom this is a handsome, durable scale designed to use—built to last—a worthy successor to the hundreds of thousands of famous Model 1124 Scales proven throughout industry! Capacity 1000 lbs. Write Fairbanks, Morse & Co., 600 South Michigan Avenue, Chicago 5, Illinois, for new Model 1124A Catalog.

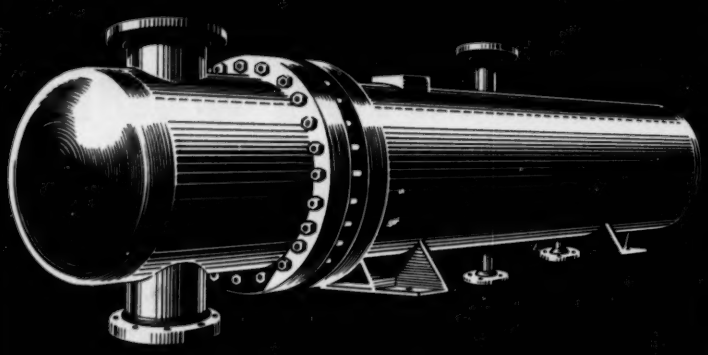
See Sweet's Plant Engineering File for full line of F-M Scales.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

SCALES • PUMPS • DIESEL, DUAL FUEL AND GAS ENGINES • ELECTRIC MOTORS
GENERATORS • COMPRESSORS • MAGNETOS • HOME WATER SYSTEMS

MANNING & LEWIS



M & L CARBON STEEL REACTIVATION CHILLER made to A.S.M.E. code (Dimensions 18" outside diameter shell, 7' overall length, weight 2000 pounds).

Today's rapid strides in the technology of processing plant operation make it essential for a manufacturer of equipment to be "staffed up" with people who have had extensive training and experience. More than half our staff have spent a major part of their working life in this one field and have played a major role in the design and fabrication of many types of processing equipment. They know the limitations and workability of all metals and how to get maximum service from each. This accumulated knowledge of base materials and our extensive experience in design and fabrication means practical, trouble-free equipment at the lowest possible cost.

It is impossible, in a field requiring such wide diversification, to illustrate, or even list, all the products we have been called upon to supply. The chiller above is simply one among thousands.

Call on us the next time you need equipment. We are fully qualified to design and fabricate to all codes.

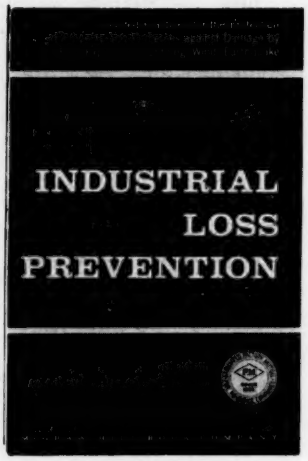
M&L MANNING & LEWIS

ENGINEERING COMPANY

Dept. A, 28-42 Ogden Street, Newark, New Jersey

DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT

TECHNICAL



Trying to Keep Up

HANDBOOK OF INDUSTRIAL LOSS PREVENTION. Prepared by the staff of the Factory Mutual Engineering Div. McGraw-Hill Book Co., New York. 864 pages. $20.

Now at long last we have, in handbook form, a compilation of the recommended practices for protecting property and processes against damage by fire, explosion, lightning, wind and earthquakes.

Prepared by experts on the engineering staff of the Factory Mutual insurance companies, this handbook should serve a very definite purpose for those not completely informed on loss prevention.

However, like all publications of its kind, it's usually five years behind actual practice. Our technological advances are so rapid that it's almost impossible for any author or authors to keep up to date with actual practice in the field.

Furthermore, the insurance groups involved in preparation of

ADVERTISEMENT—*This entire page is a paid advertisement* *Prepared by U. S. Industrial Chemicals Co.*

U.S.I. CHEMICAL NEWS

September ★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1959

New Sodium Hydride Analysis Developed

A new and unconventional method of analyzing sodium hydride for contained sodium hydride and residual sodium was developed recently at the U.S.I. research laboratories.

The determination of completeness of reaction between sodium and hydrogen to form the hydride presents a problem because of the reactivity of the latter with air and moisture. Sampling is difficult and conventional analytical procedures are inadequate since both sodium and sodium hydride yield hydrogen and caustic when treated with water.

The method developed by U.S.I., however, is actually based on the differential amounts of hydrogen and caustic formed when sodium hydride containing small amounts of sodium is treated with water in a decomposition flask.

The sample need not be weighed if only the relative amounts of sodium and sodium hydride are desired. Accuracy depends on rigorous sampling, and the best method involves the use of a small 10cc. hypodermic syringe.

Weight of sample can be obtained, if desired, by weighing the syringe (with material being analyzed) before and after introducing the sample into the decomposition flask.

A data sheet giving complete details on this method of analysis and a diagram of the apparatus can be obtained from U.S.I. upon request. Production of sodium hydride from dispersed sodium is outlined in U.S.I. Sodium Dispersions brochure, also available on request.

New Zirconium-Copper Alloy Now on Market

A recently developed zirconium-copper alloy, said to possess excellent electrical conductivity and high-temperature strength properties, is expected to find many applications in the electrical field. The new alloy consists of high-conductivity, oxygen-free copper and carefully controlled concentrations of high-purity zirconium.

It is distinguished by the high strength level it develops through cold working and the extent to which it retains this strength at elevated temperatures. A typical bar of the alloy, cold-worked 60% and aged for one hour at 400°C, exhibits the following: tensile strength, 63,000 psi; yield strength, 59,000 psi; elongation, 12%, electrical conductivity, 90-95%. At 400°C, the short time tensile strength is 46,500 psi. Additional cold-working will increase the strength of the alloy without sacrificing ductility and electrical conductivity. Endurance tests show it to be far superior to unalloyed copper.

The high softening temperature of the alloy permits welding, brazing, silver soldering. Silver plating is also practical with only minor modifications in procedures. Billets cast with the new alloy are reported to be free of inclusions and flaws — hence have better hot and cold workability.

First Interim Regulations On Tax-Free and SD Alcohols Implement 1958 "Changes" Act

Continuing Industrial Use Permit Is One of Major Changes.

The first interim regulations written to implement the Excise Tax Technical Changes Act of 1958 (Public Law 85-859, 72 Stat. 1313), which went into effect July 1 this year, were published in the Federal Register of June 12. These regulations provide for administration of the Internal Revenue Code of 1954 as amended by the "Changes" Act, and will be effective until superseded by permanent regulations.

The following changes are significant for users of pure and specially denatured ethyl alcohols:

(1) *Industrial Use Permits* — permits to use SD Alcohol, Form 1481 and Tax-Free Alcohol, Form 1447, issued effective on or after July 1, *are continuing* (unless terminated by the terms thereof, suspended, revoked or voluntarily surrendered). It was formerly necessary that these permits be renewed each year.

(2) *Withdrawal Permits* — issued on or after July 1 *expire* as follows: SD Alcohol, Form 1485, expires October 31, 1960; Tax-Free Alcohol, Form 1450, expires April 30, 1961. It was formerly necessary to obtain new permits each year.

(3) *Use of Tax-Free Alcohol* has been extended to include blood banks, educational organizations exempt from federal income tax, pathological laboratories with certain restrictions. The blood banks were not previously specified. The restrictions of use by various institutions have been clarified.

MORE

What's Cooking? World's first all-titanium frying pan is being used here by Jean Gregoire, executive chef of New York's Hotel Roosevelt, to fry eggs for hungry patrons. The experimental pan was fabricated by Mallory-Sharon Metals Corporation, Niles, Ohio (one-third owned by U.S.I.), as part of a nationwide program to promote uses for the light, strong, corrosion-resistant metal.

Ethanol Widely Used in Pharmaceutical Aerosols

Medicine in aerosol form, for therapy by inhalation, has gained considerable acceptance in the last few years. There is much well-documented clinical evidence for the suitability of aerosols in the treatment of asthma, for example. And as new aerosol formulations are developed and tested clinically, it is expected that this form of inhalation therapy will be used even more widely in the future.

Judging from a group of typical formulations published recently by *Drug and Cosmetic Industry Magazine*, ethyl alcohol is an essential ingredient in this type of pharmaceutical aerosol. Examples of bronchodilator amine

MORE

AEC OKs Operation at Full Power for World's Largest Private Research Reactor

The largest independent industrial research reactor in the world is now being operated by Industrial Reactor Laboratories, Inc. at Plainsboro, N. J., for U.S.I. and nine other companies. After extensive safety tests, the Atomic Energy Commission recently authorized operation of the reactor at its full design power level of 5,000 kilowatts (thermal).

Previously the facility had been granted authority to operate at power levels not exceeding 100 kilowatts during tests which included stringent safety studies. Upon completing these tests, the AEC supplemented its amendment to IRL's license. It now states that, in the opinion of the Commission's hazards evaluation branch, the reactor can be operated at the five megawatts rate without undue hazard to the health and safety of the public.

September ★ **U.S.I. CHEMICAL NEWS** ★ 1959

CONTINUED

Alcohol Regulations

(4) *Samples* — proprietors may now furnish without permits samples of SD Alcohol of one quart to users, applicants or prospective applicants for permits (for experimental purposes or preparation of samples to be submitted to the Director). Previously only samples up to eight ounces could be furnished without permits.

(5) *Carrier Permits* — permits are no longer required to transport tax-free, specially denatured and undenatured alcohol, including tax-free distilled spirits.

As further interim regulations are published, U.S.I. will endeavor to keep industrial alcohol users informed as to the important changes.

CONTINUED

Aerosols

formulations included one containing:

Isoproteronol HCl	0.20%
Water	2.00%
Ethanol (absolute)	37.80%
Propellants	60.00%

Typical cardiovascular drug formulations included the following:

Nicotine	1.00%
Ethanol 95%	34.00%
Propellants	65.00%

And an antispasmotic formulation given contained:

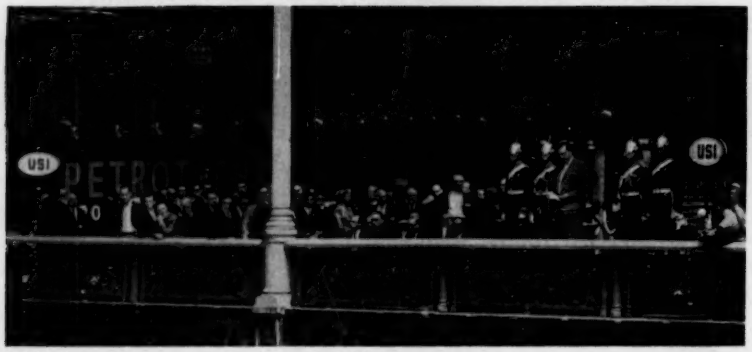
Atropine	0.1%
Ethanol 95%	9.9%
Propellants	90.0%

U.S.I. Appoints New Sales Manager for Detroit Office

On September 30th, Fred M. Henley retires as Manager of the U.S.I. Detroit Sales Division, after a long and successful career with the company. Succeeding Mr. Henley is Walter J. Kilmer, who has been associated with U.S.I. for 25 years as a sales representative for the company in the Buffalo, N. Y., area.

W. J. KILMER

U.S.I. at the International Plastics Show



U.S.I.'s booth at the International Plastics Exhibition was the background for the opening ceremony, June 17th, in Grand Hall, Olympia, London.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

New cleaning agent claimed to combine functions of solvent and detergent can now be obtained. Has low volatility, no flashpoint. Forms clear solutions with water, all chlorinated solvents, most safety solvents. **No. 1510**

New periodical on biochemical and biophysical research now being published and sold. Said to meet need for rapid dissemination of information in experimental biology. Information appears as short, well-documented communications. **No. 1511**

Water-soluble anti-caking agent said to be effective in concentrations as low as 0.025-0.05%, is now on market. Material is organic, practically salt-free. Available as 98% powder and 50% free-flowing liquid. **No. 1512**

Simple slide rule for polyethylene film and bag measurements has been developed. Permits rapid determination of width, length, total area, weight, gauge in one setting of the rule, with only one or two constants known. **No. 1513**

Diethylaminoethyl phenylethyl acetate citrate has been found, in new research, to exhibit stronger, faster broncho-dilating action than ephedrin. Cough reflex is stopped more effectively than by codeine. **No. 1514**

Chemistry of drugs is covered in new book now being sold. Both synthetic and natural drugs are discussed as to structure, preparation and synthesis, properties, uses. A table gives approved, chemical and proprietary names. **No. 1515**

New fatty-nitrogen-derived corrosion inhibitor has been developed for use in 5, 10, 15% HCl over a wide temperature range. Claimed to control corrosion on metals such as stainless steels 316 and 420, monel, bronze, mild steel. **No. 1516**

Objective measurement of odor is said to have been achieved by techniques which use the latest in ionization detector gas chromatography equipment. Permits correlation between subjective and objective odor evaluation. **No. 1517**

First chewable iron tablet for children has been introduced. Contains ferrous fumarate and vitamin C and will not stain teeth, according to manufacturer. Intended for oral treatment or iron deficiency anemia. **No. 1518**

All-polyethylene chemical pump for dispensing from drums, carboys, etc. can now be obtained. Said to operate with ease and wear-free smoothness, due to special valve design. Furnished with drum-bung adapter. **No. 1519**

PRODUCTS OF U.S.I.

Alcohols: Ethyl (pure and all denatured formulas); Anhydrous and Regular Proprietary Denatured Alcohol Solvents SOLOX®, FILMEX®, ANSOL® M, ANSOL PR.

Organic Solvents and Intermediates: Normal Butyl Alcohol, Amyl Alcohol, Fusel Oil, Ethyl Acetate, Normal Butyl Acetate, Diethyl Carbonate, DIATOL®, Diethyl Oxalate, Ethyl Ether, Acetone, Acetoacetanilide, Acetoacet-Ortho-Chloranilide, Acetoacet-Ortho-Toluidide, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Sodium Oxalacetate, Sodium Ethylate, Urethan U.S.P. (Ethyl Carbamate), Riboflavin U.S.P.

Pharmaceutical Products: DL-Methonine, N-Acetyl-DL-Methonine, Urethan USP, Intermediates.

Heavy Chemicals: Anhydrous Ammonia, Ammonium Nitrate, Nitric Acid, Nitrogen Fertilizer Solutions, Phosphatic Fertilizer Solution, Sulfuric Acid, Caustic Soda, Chlorine, Metallic Sodium, Sodium Peroxide.

PETROTHENE® Polyethylene Resins

Animal Feed Products: Antibiotic Feed Supplements, Calcium Pantothenate, Choline Chloride, Special Liquid CURBAY, Menadione (Vitamin K_3), DL-Methionine, MOREA® Premix, Riboflavin Products, U.S.I. Permadry, Vitamin B_{12} Feed Supplements, Vitamin D_3.

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BOOKSHELF

J. B. BACON

this book are obligated to follow published standards—those of the National Fire Protection Association and the National Safety Council—which as previously stated are usually five years behind actual field practice and thinking.

It is indeed regrettable that it usually takes that length of time to get new and proven techniques into accepted standards and procedures.

As an example, if you compare recent articles that have appeared in this magazine, "Safe Handling of Reactive Chemicals" (April 20, 1959, p. 157) and "See Hazards at a Glance" (Feb. 23, 1959, p. 162), with Section 37-1 of the Factory Mutual Handbook, you just don't get the same story.

Yet, we shouldn't be too critical of the authors because they have done an excellent job but are stymied by their own organizational policies of publishing only those things that have, so to speak, been proved.—MDR

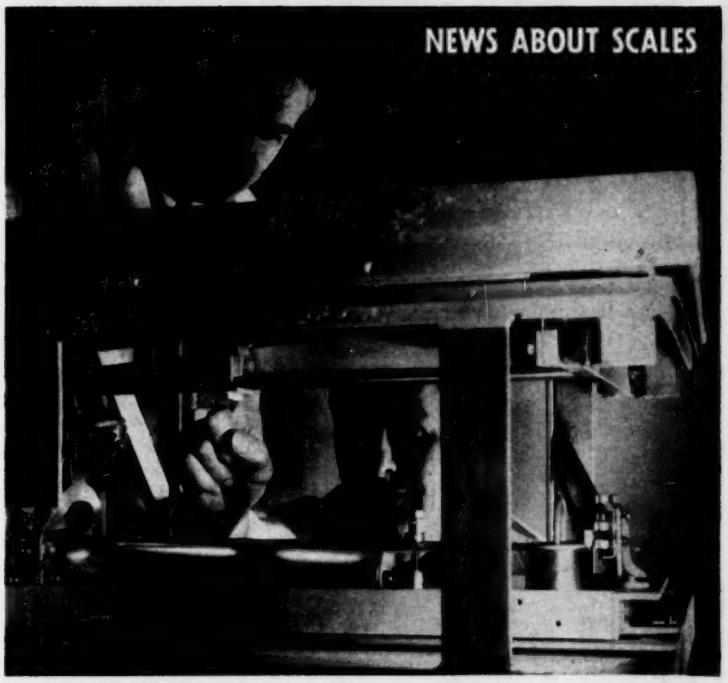
BRIEFLY NOTED

BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS, JANUARY-DECEMBER 1957. *By Sidney Katell, John H. Faber and Bryce L. Maddox, U. S. Bureau of Mines. Superintendent of Documents, Government Printing Office, Washington 25, D. C. 40¢.* Contains 283 references reflecting economic studies by Bureau of Mines on synthetic fuels.

MORE NEW BOOKS

ENGINEERING ECONOMICS FOR PROFESSIONAL ENGINEERS' EXAMINATIONS. By Max Kurtz. McGraw-Hill. $6.50.

HEATSEALING AND HIGH-FREQUENCY WELDING OF PLASTICS. By H. P. Zade. Interscience. $5.75.



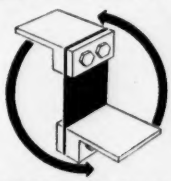
How do they build unvarying accuracy into this remarkable new kind of weighing instrument?

For 7,000 years men have employed the multi-part pivot balance to compare weights. As the parts of their pivot joints wore, the problem of retaining accuracy became more and more acute. Then in 1956 the United States issued a patent for a "Thayer Flexure Plate" Leverage System. A team of engineers and businessmen, aware of industrys great cumulative loss of materials in weighing operations, had devised a revolutionary new scale. Knife-edge pivots that progressively wear and change were replaced by Thayer Flexure Plates that move only .001", yet accurately reflect the minutest changes in weight. This *firmly joined* lever withstands shocks and vibrations indefinitely. Dirt and dust are no longer a problem.

Thayer guarantees this leverage system accurate for the life of the scale.

How Can It Save You Money Year After Year?

Working in conjunction with straight electrical controls, it forms the most reliable, low maintenance system ever devised to control processing or materials handling *by weight*. Literature on its application to filling, batching and checkweighing operations is available on request.



THAYER SCALE

AUTOWEIGHTION SYSTEMS FOR FILLING, BATCHING AND CHECKWEIGHING

THAYER SCALE CORP. THAYER PARK PEMBROKE, MASS.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER DENVER

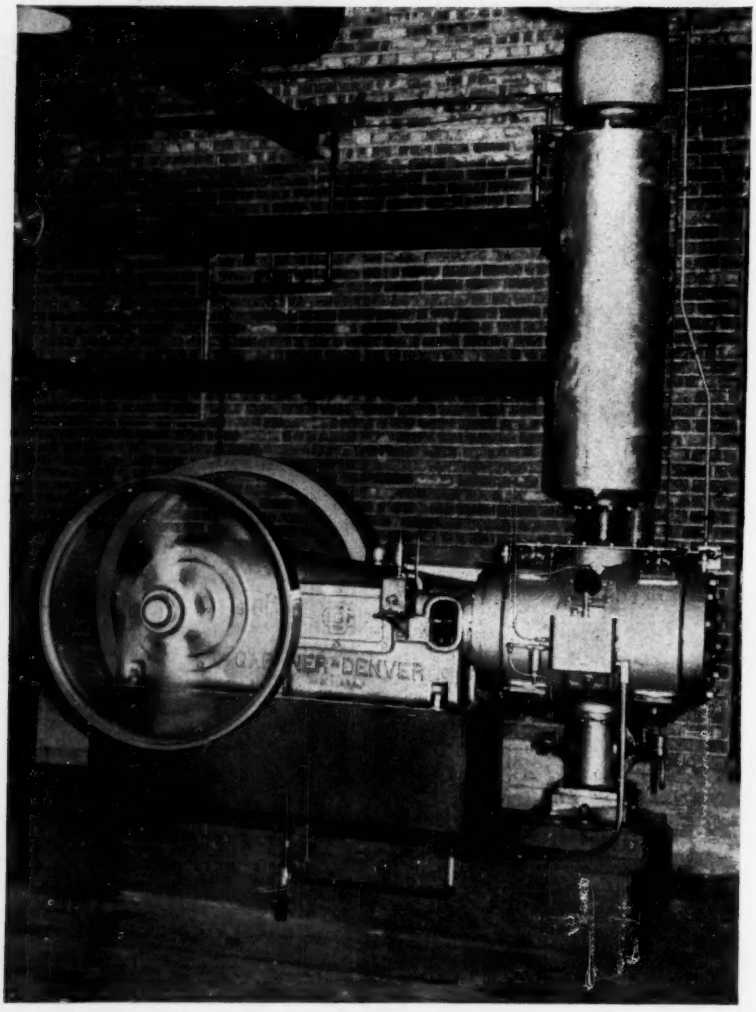
Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

For continuous compressed air power, install the Gardner-Denver RX compressor. It assures years of reliable service . . . requires only routine attention. The sturdily engineered, dirt-free power end—that's one reason. And behind the scenes at Gardner-Denver, cleanliness in every step of assembly is another key to endurance. Rigorous testing assures years of efficient, trouble-free performance. Get the full story on RX superiority for 'round-the-clock service. Write for Bulletin HAC-40. Gardner-Denver Company, Quincy, Illinois.

Built for the long run

Gardner-Denver RX



LETTERS:

Pro or Con: Unions

Sir:

While your articles concerning unionization of engineers are not quite pro engineering unions, they are definitely not anti.

I think it is time that you and other publishers took a stand on this issue. I also think it is high time our professional societies started very active campaigns to promote professionalism rather than unionism.

As you can already tell, my vote is cast for professionalism. This implies that an engineer is free to progress to the limit of his abilities and ambitions, at a pace determined by the effort he expends, his ability to reason and his readiness to make decisions. This system encourages individual effort and spurs the ambitious engineer to greater achievements.

On the other hand, unionism tends to stifle individualism. It tends to seek the common denominator for all engineers. Outstanding achievement is frowned upon because it makes the rest of the group look bad. It is good for the below-average, the dullards and the unambitious. It gives them a place to hide, a secure position as long as no major error is committed and a raise every year whether earned or not. This is not my idea of the use of a technical education!

Would you care to take a stand on this issue or do you dare?

EDMUND D. LILLY

Houston, Tex.

▶ *On matters where we were convinced we knew what was best for our readers—such as national defense—this magazine has taken firm stands. On one occasion, back in the '30's, Hitler banned Chem. & Met. from Germany because of an editorial article criticizing the Nazis.*

On other controversial questions, we believe we can best achieve our prime editorial objective—service to the reader—by maintaining a neutral position. As to unionization of engineers, we shall continue to report and interpret without trying to persuade.

PRO & CON

C. H. CHILTON

Mr. Lilly's opening statement is proof that we are succeeding to some extent. Further evidence is the fact that Ray Fremed, editor of our You & Your Job department, was recently invited by an AIChE local section to serve as "neutral" man on a three-man panel discussing questions of professionalism. Of the other two men, one represented an engineering union, the other spoke for state-registered engineers.—ED.

Bouquet and Brickbat

Sir:

Congratulations on the excellent job you did on our article in the Aug. 10 issue (pp. 125-128)!

Somehow there ought to be a way to give your associate and assistant editors more credit for the spirited manner in which they transform dull manuscripts into vibrant reading.

DONALD Q. KERN
D. Q. Kern Associates
Cleveland, Ohio

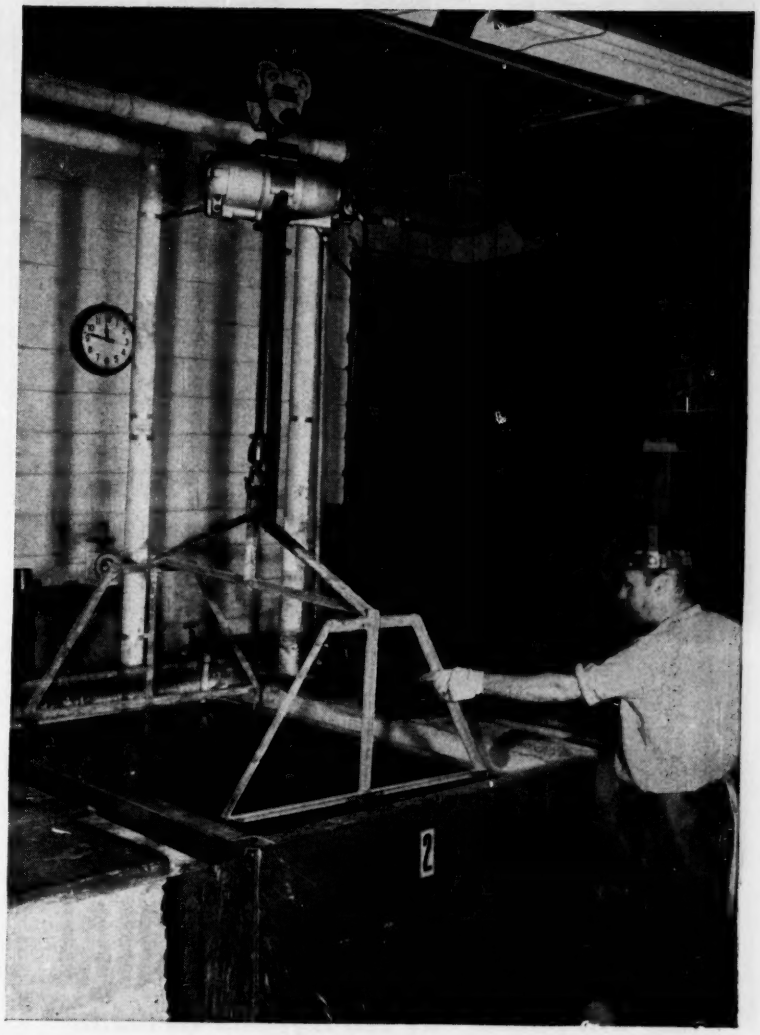
► *We appreciate this compliment, especially when a busy engineer takes the time to write a letter.*

If all our mail was complimentary, however, we'd begin to worry. Here's one calculated to deflate any editorial egotism in a hurry. We print it exactly as received.—ED.

Sir:

Rather than silently and unproductively damning your magazine biweekly, I've decided to write you in the hope that my one small voice, if raised loudly and nastily enough, will apprise you of a readership which you obviously are unaware exists—so here goes!

What, in the name of Robert Boyle do you think you are doing to the English language? Is this a sentence?—"Recovery system captures sulfuric acid fumes vented from pots." (p. 63, July 27, 1959) To my mind, it reads like a caption or the statement of a rather bright engineer from Germany after studying Ameri-



Faster, safer acid baths

use Gardner-Denver air hoists

In the application shown above, trays of parts for air-conditioner condensers are dipped in acid and water baths during processing. Using a Gardner-Denver one-ton air hoist with pendent control, operator has complete control as tray is lowered *swiftly and steadily* into bath.

Hoist protects operator two ways. First, there's no chance of electric shock when working near fluid. Hoist is powered by a non-sparking axial-piston air motor. Second, pendent control allows operator to stand away from splashing acid.

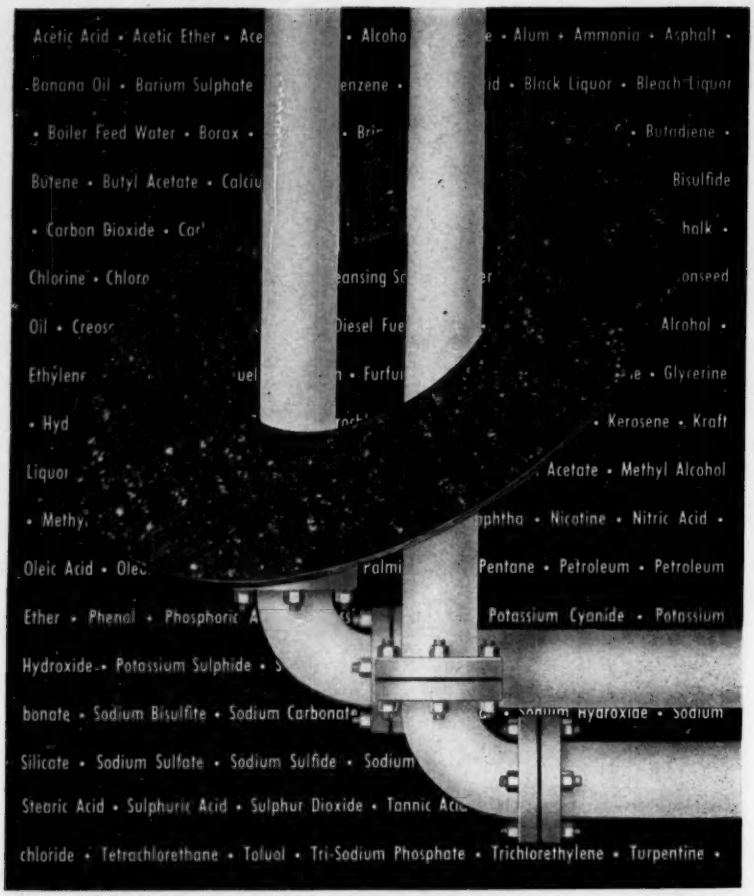
Gardner-Denver air hoists from 150 lb. to 2 tons. Write for Bulletin 80.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario


Acetic Acid • Acetic Ether • Ace
• Alcoho
• Alum • Ammonia • Asphalt •
Banana Oil • Barium Sulphate
• Black Liquor • Bleach Liquor
• Boiler Feed Water • Borax •
• Butadiene •
Butene • Butyl Acetate • Calciu
Bisulfide
• Carbon Dioxide • Cor
halk •
Chlorine • Chloro
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Liquor
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• Methyl
• Nicotine • Nitric Acid •
Oleic Acid • Olec
Pentane • Petroleum • Petroleum
Ether • Phenol • Phosphoric A
Potassium Cyanide • Potassium
Hydroxide • Potassium Sulphide •
bonate • Sodium Bisulfite • Sodium Carbonate
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The versatility of this material results from the use of a greater percentage of selected Canadian asbestos fibre, of the spinning group, than is found in any other gasket material. The asbestos is skillfully compounded with a special binder. Every square inch of the sheet has uniform density, thickness and asbestos distribution.

DURABLA Sheet Packing is available in eight different gauges. Gaskets are supplied in all sizes and shapes, accurately machine cut.

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DURABLA

DM-37 *Manufacturers of DURABLA Pump Valves and Check Valves*

PRO & CON . . .

can technology and language for about two weeks.

Really, you are killing not only the language but also any interest the articles in your magazine may have by writting them in this pseudo-engineering jargon.

Do you realize that there is not one article with the slightest bit of humor in it in your magazine? Do you think all engineers are dull, witless, sub-intelligent machines interested only in a recitation of inconsequential facts, such as those presented in Julian Nardi's article? Have you read that thing? Here is a man who has had firsthand experience in designing one of the most exciting projects imaginable—the Pitt. Consol Coal Pipeline—and he doesn't even mention it. Wouldn't you have rather read of the design problems encountered and how he solved them? Wouldn't we have all learned more about what a solids pipeline is all about and more about what Mr. Nardi is all about if he had done this?

Do you have any idea of how ridiculous your ten-word sentences appear to anyone who has any feeling at all for the written word? Are we to be subjected to the language of uneducated technicians in our own journal when the aim of our education has been to prepare us to be professional men? Don't you think you have the obligation to all of us to present the best of what our profession can write instead of what is obviously the worst?

I could go on for pages, but all I could write would only emphasize the fact that I cannot remember ever having read a publication as poorly written and edited as *Chemical Engineering.*

MARTIN EDENBAUM
Johnson & Johnson
New Brunswick, N. J.

▶ *We won't bother to defend in these columns the use of short sentences by the "uneducated technicians" on our editorial staff of 20 graduate engineers. But we are quick to defend Mr. Nardi, author of "Pumping Solids Through a Pipeline" (July 27, pp. 119-122).*

In the first place, Mr. Edenbaum is dead wrong when he says that the article makes no mention of Consolidation Coal Co.'s coal pipeline.

More important, he overlooks one very real fact of life in the

ACCURATE!

The TAYLOR WATER ANALYZER

Has Guaranteed Color Standards That Give DEPENDABLE Data

For fast, yet completely accurate tests of color, ammonia, nitrite, nitrate, chlorine, total iron, manganese, silica, copper, fluoride, bromine, aluminum, nickel and low chromate, use a Taylor Water Analyzer. One basic, low-cost unit is adaptable for use with 18 guaranteed color slides. Allows you to make practically any determination required in plant operations. Ideal for obtaining the pH of unbuffered or slightly buffered liquids Tests are made in only minutes. No fragile glass standards to handle. Complete instructions included with every set.

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Contains color standards covering the 0-10 ppm range which can be extended by diluting the sample. Sealed-in-plastic color standards virtually eliminate mechanical error.

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for testing pH, phosphate

Be sure to use only Taylor reagents and accessories with Taylor Comparators to assure accurate results. Taylor color standards are guaranteed against fading.

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HOT SPOT in *your* plant?

Chances are 1 in 3 that your plant will have an electrical fire this year. Here's how to guard against it.

In a recent nationwide industrial survey, 29% of the reporting plants had one or more electrical fires during the past two years. Best protection against larger electrical fires? Install a fully-automatic Kidde carbon dioxide fire extinguishing system.

Finest fire protection on the market today, Kidde systems give you 24-hour-a-day protection, act quickly, dependably at the first sign of fire. Kidde systems are pressure-operated, self-contained – need no outside power. Visual indicators show if system is "set" or "released." All parts can be tested without discharging system. No parts to replace after operation or test. All operating parts completely enclosed for safety. Fast, clean carbon dioxide snuffs fire in seconds, then vanishes. Leaves no mess to clean up later, can't harm electrical gear. For more information, write for Kidde's Pressurized Systems booklet today.

Kidde (K Kidde) **Walter Kidde & Company, Inc.**
928 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto—Vancouver

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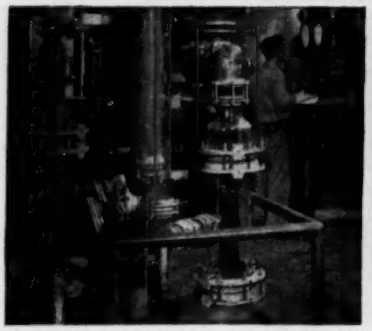
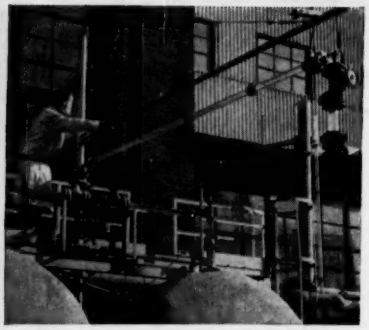


At Trubek Laboratories, Inc., East Rutherford, N. J., 1500 feet of PYREX pipe is used in this reaction system.



Outside storage and unloading station has 200 feet of 2-inch PYREX pipe as well as glass swivel booms.

Inside and out... at Trubek Labs they

TAME TOUGH CORROSIVES

with PYREX® glass pipe

INSIDE Trubek Laboratories, Inc., you'll find a four-component continuous reaction system for handling chlorine, HCl, and a number of corrosive organics.

Part of this system is piping—1000 feet of 1-inch and 200 feet of 2-inch PYREX brand *glass* pipe. Also included are PYREX brand glass Y-valves and Shell and Tube Heat Exchangers.

OUTSIDE at Trubek, you'll see an acid chloride storage system and tank truck unloading station. Here you'll find an additional 200 feet of 2-inch PYREX pipe, as well as special swivel booms made from glass.

Why does Trubek pick *glass* pipe for taming tough corrosives? Because this pipe is made from PYREX brand glass No. 7740. This is the glass that is resistant to more acids and acidic materials than any other pipe. It's the same glass in which laboratory tests for the chemical durability of other corrosion-resistant materials are generally carried out. And you are assured of product purity because PYREX pipe does not contaminate even the most sensitive product.

And, you can *see* what's going on in every inch of PYREX pipe. Should blockage occur—a rare happening because glass is so *smooth* — you can quickly spot it, without costly downtime and dismantling.

Is glass pipe fragile? Not PYREX pipe because it's made to stand up to high temperatures, pressure, and considerable mechanical shock.

How about costs? If you consider that installing glass often requires less time than other materials, you can start with at least one saving. But the *big* economy comes from the fact that glass *lasts*. Example: One firm reports that, after 9 continuous years of piping chlorine through 1600 feet of PYREX pipe, they had no corrosion at all. And maintenance had cost only $6.32 per year.

Why not put all the facts and figures about pipe for handling corrosives at your finger tips. Send for Bulletin PE-3, "PYREX brand 'Double-Tough' Glass Pipe and Fittings." Use the coupon for quick action on your request.

CORNING MEANS RESEARCH IN GLASS

CORNING GLASS WORKS

1 Crystal Street Corning, New York

Please send me: ☐ PE-3, the manual on PYREX brand glass pipe.
☐ PE-4 on the all-glass Y-valve.

Name..... Title.....

Company..... Address.....

City..... Zone..... State.....

PRO & CON . . .

American system of free enterprise —the right of an individual or company to keep its know-how secret. As long as Consolidation Coal so chooses, both Mr. Nardi and his employer (Ford, Bacon & Davis) are obligated, ethically as well as legally, to maintain in confidence the know-how won by Consolidation at great cost in time and money.

Having had a request for a detailed engineering article standing with onsolidation Coal Co. for some eight years, we hope to be among the first to publish this know-how when it is finally released.—ED.

Mark of Distinction

Sir:

Regarding Mr. Gray's article on "Why Engineering License Laws?" in your July 13 issue (pp. 166-170), I find myself in disagreement.

I am a professional engineer by examination. I feel the great value of a professional engineering license is that it requires an individual to take an examination after he has been in industry for a period of time, usually about seven years. These examinations are ordinarily rather difficult. It is my feeling that being able to pass an examination after being out of school for that period of time is a definite mark of distinction for any engineer.

It is much too easy for engineers to get categorized with "the rest of the help." More power to those engineers who have the self-respect, spirit and determination to obtain a professional engineer's license.

J. A. PERRY

Cherry-Burrell Corp.
Cedar Rapids, Iowa

Critical Temperature Error

Sir:

Please note that Eq. (12) in my article, "Predict Critical Temperature" (June 15, pp. 181-184) is in error. The first term on the right-hand side should be log 19.078 (or 1.28053), rather than 19.078.

WALLACE R. GAMBILL

Union Carbide Nuclear Co.
Oak Ridge, Tenn.

ADAMS CATALOG FILE

These Bulletins will help you solve your compressed air and liquid filtration problems.

For more than twenty years, the R. P. Adams Co. has worked with engineers to improve compressed air and simplify liquid filtration. The following literature reflects this wide experience — why not take advantage of this know how — write for your copies today?

Air and Gas Aftercoolers and Cyclone Separators

... provide effective low cost moisture removal from compressed air and gasses. Wet compressed gasses must be freed of damaging moisture before they can be safely used in air operated tools, equipment and instruments or other applications. The counterflow, water-in-the-shell design affords highly efficient vapor condensation. Models are available for cooling the gas to within 10° or 2° of the cooling water — dependent upon the dryness required. The Cyclone Separator then effectively removes condensates over a wide range of flows. This combination assures you of moisture free — trouble free compressed air and gas with less than ½ P.S.I. pressure loss. Models are available from 60 - 44,000 CFM in working pressures up to 1000 P.S.I.

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Ask for ..... Bulletin 117

Adams Chemical Filters

... provide an effective method of solids removal. Completely enclosed construction coupled with dynamic back wash design provides contamination free — low cost separation. The availability of a variety of filter media meets the needs of any process. A wide selection of materials of construction—including lead and rubber linings—models in jacketed construction—can be supplied in various sizes and capacities. Investigate the many benefits of the Adams Chemical Filters.

Write for ..... Bulletin 431

Adams Industrial Filters

... are ideal for the filtration of process liquid and gasses as well as polishing industrial water and waste. An assortment of filter elements to provide efficient filtration for virtually every industrial application are available. Sizes are made to suit any process requirement. For complete details of how Adams filters can reduce your processing costs, write for ..... Bulletin 651

Where automatic water filtration is required, request ..... Bulletin 909

R & D — Pilot Plant Filters

... are available as self contained filter packages—including pre-coat equipment. The JWF-28, completely assembled and mounted on a skid, is available for pilot, research and development or for small process applications involving flows up to 80 GPM. You make only three connections. For complete information, write for ..... Bulletin 610

R. P. Adams Co., Inc., 207 East Park Drive, Buffalo 17, New York.

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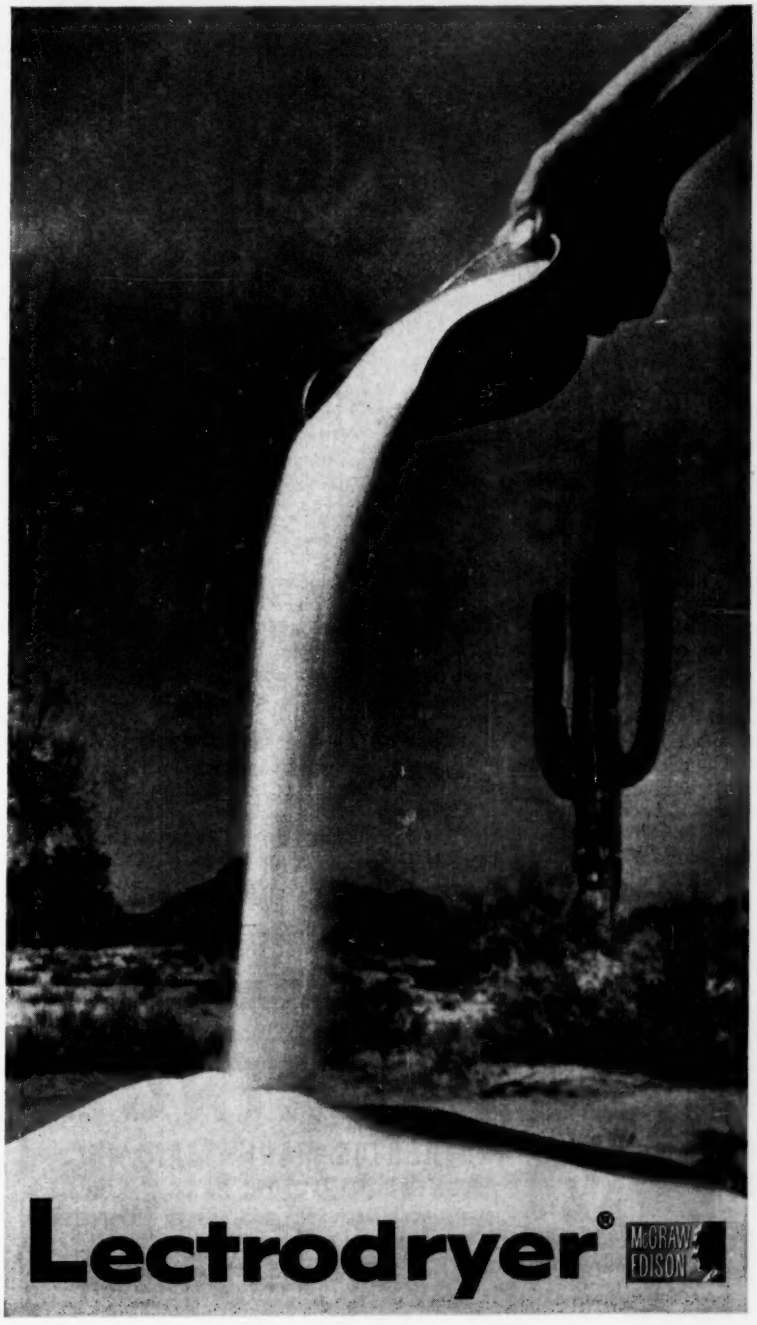

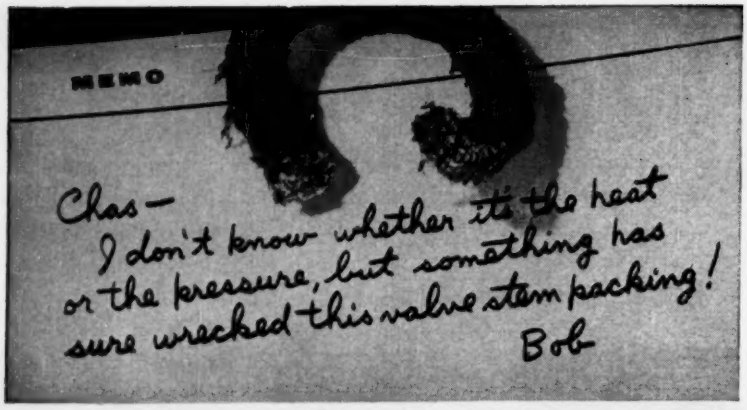

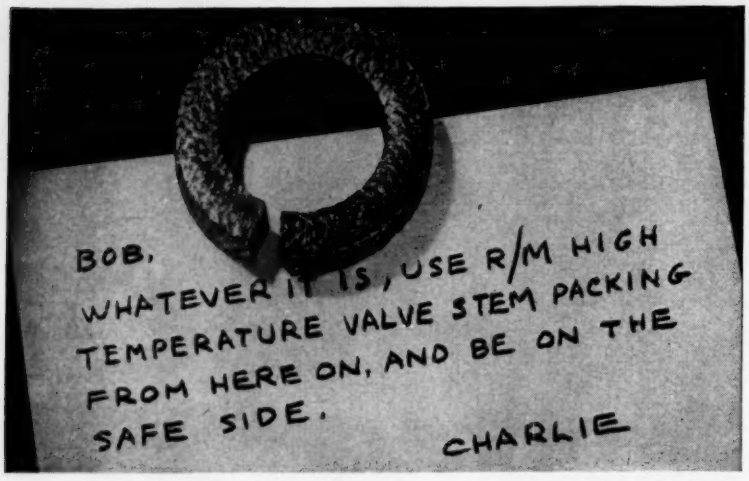

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READER SERVICE . . .

TECHNICAL

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Chemicals

Acrylontrile.....is added to pulp to modify its chemical structure & greatly strengthen heat-resistance & retention of dielectric & tensile strength properties.
20-21e *American Cyanamid Co.

Adhesives.....4 p. bulletin A-1 contains tabular data describing company's Hysol line of adhesives, most of which are epoxy compounds. Heat cure and RTC varieties.
216A Houghton Laboratories Inc.

Aero Glycolonitrile.....The availability of Aero Glycolonitrile has made possible the use of an easier & better method for producing a-amino acids. Information.
20-21c *American Cyanamid Co.

Anti-static Agent.....Catanac SN is effective on fibers, including the synthetics. Application may be made by brush, pad, or spray &, washable items by adding water.
20-21d *American Cyanamid Co.

Benzoic Acid.....Information on new crystal Benboic Acid available upon request. Crystal form available in both U.S.P. and technical grades. Send for your copy.
35a *Hooker Chemical Corp.

Carbonate of Potash.....An easy-to-use fact filled guide book contains data on safest way to store and handle carbonate of potash. Available now.
35d *Hooker Chemical Corp.

Caustic Potash.....An easy-to-use fact filled guide book contains data on forms, grades, and shipping methods. It is available on your request.
35b *Hooker Chemical Corp.

Caustic Soda.....An easy-to-use fact filled guide book contains data on on the safest way to store on handle liquid caustic soda. It is available on request.
35c *Hooker Chemical Corp.

* From advertisement, this issue

LITERATURE

E. M. FLYNN

Chemicals.....A 16-page booklet lists the many chemicals available, such as; vinyl stablizers, fluorides, glycerine, synthetic optical crystals, fungicides, etc.
42 *The Harshaw Chemical Co.

Chemicals, Custom-Made.....8 p. booklet describes biochemical & chemical facilities for custom production. Nine unit processes are available.
217A Commercial Solvents Corp.

Cleaning Agents.....claimed to combine functions of solvent & detergent can now be obtained. It has low volatility, no flashpoint. Information No. 1510.
207-208e *U. S. Industrial Chemicals Co.

Dye.....Colcogas Rocket Red dye is non-dusting, non-caking & extremely soluble, its granulated form facilitates use in automatic metering & mixing equipment. Details.
20-21a *American Cyanamid Co.

Ethanol.....widely used in pharmaceutical aerosols. Medicine in aerosol form, for therapy by inhalation has gained considerable industry acceptance.
207-208c *U.S. Industrial Chemicals Co.

Fused Zirconia.....Excellent resistance to thermal shock and abrasion. Extremely high melting point (4,620°F). Advice available upon request.
55 *Norton Company

Glass Fabrics.....2 p. data sheet contains description and typical properties on stock item silicone rubber coated fabrics for many applications.
217B Connecticut Hard Rubber Co.

Heavy Liquids....12 p. "Heavy Liquids for Sink-Float Density Determinations in Qaulity Control & Research" describes both organic and aqueous liquids.
217C Engineered Materials

Lauryl Mercaptan.....mercaptan structure that freezes below 0°C and boils over 100°C, has light color, little odor. Information available on request.
35e *Hooker Chemical Corp.

* From advertisement, this issue

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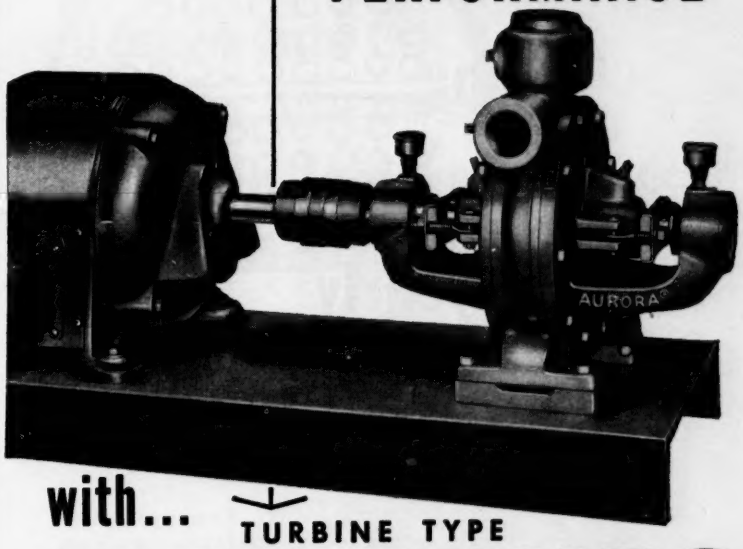

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APCO PUMPS

- PROVEN DEPENDABILITY
- CALCULATED CAPACITIES
- RUGGED CONSTRUCTION
- HIGHEST QUALITY CONTROL
- APPLICATION ANALYSIS
- SELECTED COMPONENTS
- MINIMIZED WEAR
- SERVICE FLEXIBILITY
- PRESSURES TO 400 P.S.I.
- CAPACITIES TO 150 G.P.M.

Ruggedness of construction and simplicity of design of APCO turbine type pumps combine to provide longer life, high efficiency, and minimized down time. This means more for your "pump operating dollar." With APCO *steep impeller* characteristics there is little capacity change under fluctuating head conditions. Select from the "1001" types, sizes, and capacities of AURORA pumps to obtain *the one* specifically designed to fit your needs.

APCO turbine type pumps are most frequently used for: Boiler Feed, Condensate Return, Fresh Water Service, Brine Service, Ice Water Circulation, Filter Service, LPG Service, Transfer Service, Caustic Liquid Handling, Sprinkler Service, Spraying Service, Water Treatment, Booster Service, and High Temperature Service.

WRITE TODAY FOR NEW BULLETIN S-111

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
670 LOUCKS STREET • AURORA • ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

Do-it-yourself cleaning saves chemical plant $800 yearly on each exchanger

A midwest chemical plant, running a battery of eight 20-foot oil cooler exchangers, found its average cost per yearly cleaning of each exchanger was $1100. Searching ways to cut costs, they called in their local Oakite man.

Here's what happened. The Oakite man studied the exchanger set-up and the type and quantity of deposits to be removed. He recommended the particular Oakite cleaning compound exactly suited to the purpose. Then—Oakite service being what it is—he donned coveralls and boots and stayed on the job supervising and testing while circulation cleaning took place on the worst exchanger of the lot.

This exchanger had been so fouled up that when it was removed from the line it made only one degree difference in temperature change. After a 24-hour cycle of circulation cleaning, it was put back in the line. Temperature change—13 degrees! The plant men who inspected it judged it to be 95% clean.

Best of all, cost of cleaning an exchanger, including time and materials, went down from $1100 to less than $300.

Exchanger cleaning is just one of the many chemical plant maintenance operations where Oakite can help to cut costs. For the full story, talk to your local Oakite man or write for detailed literature to Oakite Products, Inc., 16H Rector Street, New York 6, N. Y.

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SCIENCE
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LITERATURE . . .

Magnesium Oxide.....Only MgO produced by thermal decomposition. High resistivity and refractory properties at relatively low cost. Details available.
57 *International Minerals & Chemical

Mica, Glass-bonded.....Inaugural issue of house organ, "Mycalex News," will report on developments in high temperature insulation. Send for your copy.
218A Mycalex Corp. of America

Phthalic Anhydride.....A new process involves catalytic oxidation of napthalene in fluid bed converters —results in greater purity. Information on Phthalic Anhydride.
20-21b *American Cyanamid Co.

Plastics.....12 p. booklet gives results of ASTM test on company's styrene, polyethylene and vinyl chloride molding compounds. Includes data on typical uses.
218B Monsanto Chemical Co.

Potassium Carbonate.....Solvay Potassium Carbonate comes in 3 handy forms—99-100% calcined, 83-85% hydrated and 47% liquid. Information available.
93 *Allied Chemical Corporation

Reagents.....8 p. directory list approximately 250 reagents produced for medical research and biochemical analysis. Included are many for histochemical method.
218C Borden Chemical Co.

Silicone Paints.....Silicone paints last longer. Write for descriptive brochure for more information on "Why Silicone-Based Paints Mean Less Maintenance."
47 *Dow Corning Corporation

Sodium Hydride Analytical Method.... Data sheet giving complete details on this method of analysis and a diagram of the apparatus can be obtained on request.
207-208a *U.S. Industrial Chemicals Co.

Sulfuric Acid.....1 p. oleum-sulfuric acid blending chart is intended as an aid in projecting and obtaining desired concentrations from those available.
218D Bacon Chemical Industries

Surfacing Material.....Properties, recommended applications of a floor surfacing material, emery and epoxy resin, are set forth in 2 p. bulletin EX-1.
218E Walter Maguire Co.

Sulfuric Acid.....General Chemical has 21 sulfuric plants as well as stock points in key industrial centers across the county.
73 *General Chemical Div., Allied Chem.

Construction materials

Alloys.....Full information on Haynes corrosion resistant alloys, their properties, forms and the corrosives they will resist is now available on request.
183 *Haynes Stellite Co.

Alumina.....The lowest soda content available in commercial grades of hydrated alumina. Further information on Alumina is available on request
169 *Aluminum Co. of America

* From advertisement, this issue

LITERATURE . . .

Butyl Rubber.....offers outstanding resistance to weathering, sunlight, heat & electricity . . . abrasion tear & flexing . . . superior damping properties, etc. Details.
173 *Enjay Company, Inc.

Clad-Platinum Group Metals.....Cut costs without reducing the efficiency of pure platinum—group parts. For more information, write for bulletin.
4 *Metals & Controls

Coatings.....“D-A” Coatings are applied by brush or spray & can be air dried or baked. Will withstand temperatures up to 600 F. Catalog MPC outlines all coatings.
TL229 *The Markal Company

Corrosion Guide.....lists & describes the more common alloys that resist corrosion. Approximate physical & mechanical properties are given plus application & suitability.
219E The H. M. Harper Co.

Fabrication.....The illustrated Weldment Bulletin 7001 gives you an excellent idea of the vast fabricating facilities that are available.
131 *Baldwin-Lima-Hamilton

Gaskets.....Teflon-jacketed gaskets come in four basic designs. Long-lasting for piping, flanges & fittings. Complete details available in Catalog AD-154.
24-25b *The Garlock Packing Co.

Insulation.....Sample of Foamglas & information on two new products; Foamglas Stay-Dry Pipe Insulation & new 1¾” Foamglas Roof Insulation is available.
130 *Pittsburgh Corning Corp.

Packings.....“Lattice-Braid” teflon will withstand temperatures ranging from —90 F to +500 F. It is long-lasting & chemically-inert. Information in Catalog AD-131.
24-25a ***The Garlock Packing Co.**

Protective Coatings.....Kerpon minimizes corrosion in tanks, vats, pipes, etc. Protects against highly concentrated acids, fumes, caustics, etc. Information.
BL221 *Kerr Chemicals, Inc.

Rubber & Plastic Tank Linings..... for alkalies, acids, bleaches, salts. Faultless seams, indestructible bond, shock and age-resistant. Bul. CE-53.
194b *American Hard Rubber Co.

Sheet Packing.....is available in 8 different gauges. Full information about the all-purpose gasket material is contained in bulletin CE 99 which is now available.
212 ***Durabla Mfg. Co.**

Stainless Steel.....Information on grades, prices, and availability of stainless steel. For more information on stainless steel write for further details.
41 *Armco Steel Corporation

Stainless Steel.....For corrosion problems, consider nickel-containing stainless steels. A 34-page booklet is now available. Send for your copy.
110 *The International Nickel Co., Inc.

* From advertisement, this issue

NEW ELLIOTT TUBE EXPANDERS roll tubes into thick sheets in one pass

Use of **NEW** continuous-rolling technique here—shows uniform seal, with all Keys preserved, and no signs of shear

OLD step-rolling method results in non-uniform surface . . . distortion of Keys where rolls have overlapped

Better seal...Smoother surface... Much Faster operation

This new concept in tube expanders was developed by Elliott to roll the thickest tube sheets. Using a continuous-rolling method, it eliminates many problems common to step-rolling, may be operated protractively or retractively, saves time, assures uniform, smooth surfaces, avoids annular voids or erratic tube inside diameters, provides better seal.

Accessories

Elliott also makes a complete line of retubing accessories, including both electric and air magnetic Tube Rolling Controls, Tube Gages, Tube Plugs, Tube Cutters, etc.—in addition to a complete line of tube expanders. *Ask for Bulletin Y-52.*

ELLIOTT Company
LAGONDA PLANT, SPRINGFIELD, OHIO
Y9-5

Ingersoll-Rand

MOTORPUMP

FOR MORE THAN 90 YEARS Ingersoll-Rand pumps have been demonstrating that highest quality construction means low-cost pumping efficiency.

Modern, compact Motorpumps—designed in a wide range of types and sizes, and *always* available—are meeting requirements in hundreds of varied installations.

Motorpumps will deliver from 5 to 2800 gallons per minute. They operate in any position and save valuable floor space as well. Write today for complete catalog data.

9-825

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

LITERATURE . . .

Stainless Steel.....Folder describes a sulfuric - acid - resistant stainless steel called Union 20-S. Lists forms in which the alloy is stocked. Corrosion information.
219B Union Steel Corp.

Stainless Steel Wire.....Illustrated 20-page booklet fully describes analyses, physical properties, corrosion resistant & principal application of stainless wire.
163 *Allegheny Ludlum Steel Corp.

Teflon.....A new ready-reference book illustrates & describes the broad range of packings, gaskets, sheets, tapes made of Chempac Teflon. Brochure PK-124A.
119 *Johns-Manville

Zirconium-Copper Alloy.....said to possess excellent electrical conductivity & high-temp. strength properties is expected to find application in electrical field.
207-208b *U. S. Industrial Chemicals Co.

Electrical & mechanical

Actuators.....Powerful electric gear-driver actuators are designed to convert manual valves to automatic without removing valve bodies from line. Catalog.
75c *General Controls

Fixtures....."EFU" explosion-proof fluorescent fixtures are available in 2, 3, or 4 lamp models. Wattages, types of fixtures or complete specifications offered.
68b *Appleton Electric Co.

Flanges.....in all popular types and sizes are available. A new 36-page pocket-size booklet containing useful data on flanges is handy for reference.
124 *Phoenix Mfg. Co.

Floodlights.....Intenso Alzak Aluminum floodlight provides high-intensity, trouble-free illumination year-round. Details available on request.
68a *Appleton Electric Co.

Gearmotors.....offer a wide variety of sizes in single, double, triple or quadruple reductions . . . horizontal or vertical foot or flange mountings. Bul. MU-227.
125-126a *Wager Electric Corp.

Lubrication System.....An exclusive feature of these motors is Lubriflush. Old grease is completely flushed out as new grease is forced in. Full information in bulletin.
43 *U. S. Electrical Motors Inc.

Motor.....with a built-in corrosion protection. Complete design details and other information on corrosion-proof motors is contained in Bul. B-2406.
251 *Reliance Electric & Engr. Co.

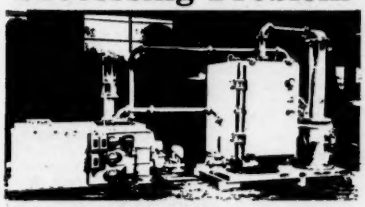
Motors.....Open-type motors with Poxeal insulation. A durable case of epoxy-resin encloses the winding end turns and slot portions of the stator. Information.
191 *Allis-Chalmers

Motors.....Type DP is available with ball bearings or with high load carrying capacity sleeve bearings for extra quiet operation. Bulletin Mu-223.
125-126b *Wagner Electric Corp.

* From advertisement, this issue

J. P. DEVINE

Solves another Processing Problem



BIG PROBLEM

To remove a foreign element from a product without changing the nature of the product and recovering the foreign element.

SOLUTION, A Devine design vacuum chamber dryer using a dual heating shelf. Steam was the pre-heating element, molten salt furnished the elevated temperature.

J. P. Devine can solve your problems, regardless of how tough they are. For complete information, write:

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DES PLAINES, ILLINOIS • P. O. BOX 189

You can automate from bin to batch with Richardson equipment

Whether your requirements are large or small, a Richardson Select-O-Weigh automatic proportioning system offers you the advantages of – **1.** Savings in labor costs. **2.** Increased productivity. **3.** Quality control. **4.** Better housekeeping. **5.** Permanent printed records. Incorporated into and governed by a Select-O-Weigh System are such units as –

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Controls – Program your production and processes by punched card, formula board, formula capsule or weight-selector verniers. Only Richardson offers all four. Control is from a single electronic panel board, operated by one man. No special training is required.

Readout–Richardson furnishes counters, totalizers, printers, typewriters and recorders of all types.

Richardson's nationwide network of service facilities is at your disposal within 24 hours if required. Likewise, Richardson helps you at start-up of your system and thoroughly checks it in operation. For full details on how you can automate your processing with Richardson equipment, write or call today. 1791

Richardson Scales conform to U.S. Weights and Measures H-44 for your protection.

Here's the answer . . .

Richardson
MATERIALS HANDLING BY WEIGHT SINCE 1902

RICHARDSON SCALE COMPANY • CLIFTON, NEW JERSEY
Sales and Service Branches in Principal Cities • Also manufactured in Europe to U.S. Standards.

Darling fully revolving double disc parallel seat gate principle features simplicity, ruggedness and smooth, dependable operation. No wedging pressure whatever during gate travel. On closure, discs automatically adjust to seat rings throughout life of valve.
This gate valve idea

saves time and money throughout industry!

DARLING gate valves, employing the principle shown in the cutaway above, offer a prolonged bonus in positive closure, freedom from trouble and long life. Such features as uniform wear distribution, elimination of disc-to-seat galling and compensated seating just naturally mean less maintenance, less down time, less expense through the years!

These trouble-free Darling gate valves are offered in sizes, types and metals for all kinds of normal or unusual services. Write for new Catalog No. 57.

ENGINEERING SERVICE: Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.

DARLING VALVE & MANUFACTURING CO.
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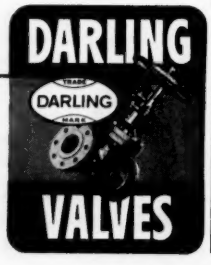
Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.



LITERATURE . . .

Motors.....extra protected against corrosive or abrasive elements. Effective cooling system adds to motor life. Write for Bulletin MU-224.
125-126c *Wagner Electric Corporation

Speed Reducers.....New Delroyd single reduction speed reducers are available in a wide range of sizes & horsepower ratings. New 32-page Bulletin 3805 offered.
115 *De Laval Steam Turbine Co.

Starter, Air-Break.....gives certified 100/150 MVA fault protection. Front accessible without roll-out. For more information write for Bulletin 8130A.
63 *The Electric Controller & Mfg. Co.

Starters.....Details on combination starter in screw type enclosure for hazardous gas & hazardous dust locations, contained in Bulletin 713. Send for your copy.
111 *Allen-Bradley Co.

Thermowells.....Bar-stock & built-up wells available with your choice of mounting flanges & bushings. Many types in stock. Catalog & Materials Applications Guide EE.
BL235 *Thermo Electric Co., Inc.

Turbines.....A complete range of power-packed turbines, from 1 HP to 250 HP. Built to customer specifications. Further facts on turbines in new Catalog 200.
31 *Coppus Engineering Corp.

Turbines.....broadest line of wheel sizes and design capabilities for steam conditions through 2400 psig. Write for further information on turbines.
52 *Westinghouse Electric Corporation

Turbines, Gas.....feature single combustion chamber—using gaseous or liquid fuel. For details, write for Bulletins 162 and 163-1. Send for your copy.
18-19 *Clark Bros. Co.

Variable-Speed Drive.....Bulletin 195 gives detailed information on construction, applications, ratings, etc. of new Speed-Trol variable-speed drives.
222A Sterling Electric Motors

Handling & packaging

Air Hoist.....is powered by a non-sparking axial-piston air motor. Available from 150 lb. to 2 tons. Further information contained in Bulletin 80.
211 *Gardner-Denver Co.

Automatic Bag Closer.....Model BA-6 sews at rate of 30 feet per minute. Details & complete catalog-file of bag closing equipment are available.
TL233 *Dave Fischbein Co.

Automatic Proportioning System..... Select-O-Weigh incorporates such units as Feeders, Scales, Controls and Readout. Full details on how you can automate your processing.
R221 *Richardson Scale Co.

Bucket Elevators.....A complete line makes it easy to select the proper type bucket elevator & components best suited to your material & capacity requirement. Details.
29 *Link-Belt Co.

* From advertisement, this issue

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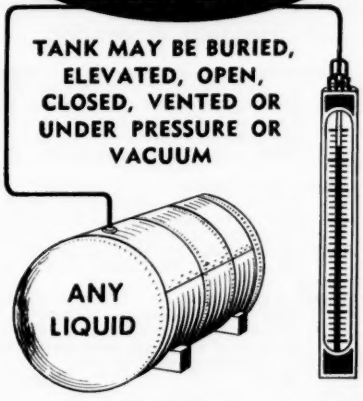
FOR MEASURING TANK CONTENTS ANY DISTANCE AWAY

TANK MAY BE BURIED, ELEVATED, OPEN, CLOSED, VENTED OR UNDER PRESSURE OR VACUUM



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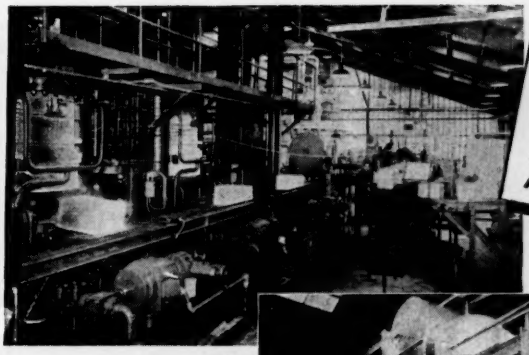
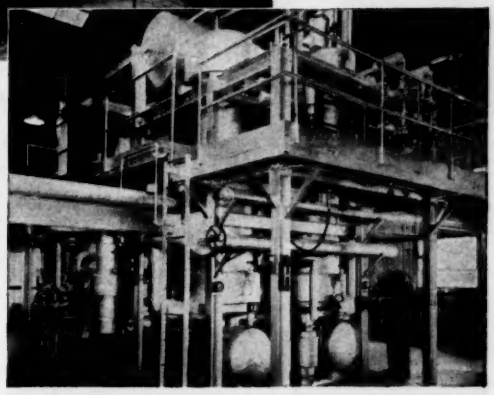


Each of the Cardox Corporation's three presses forms 240-lb. cakes of dry ice in 5½ minutes.

At Cardox Corporation's modern Memphis, Tennessee plant, Vilter vertical condensers change carbon dioxide gas into liquid. Vilter supplied a total of 18 custom designed vessels of which several are shown here.



Vilter Report Card

Grade	
A	Sturdy Construction
A	Reliable Performance
A	Low Maintenance
A	Efficient Design

100 tons of CO_2 produced per day using 18 Vilter pressure vessels

Using a new low pressure process, the Cardox Corporation's Memphis Plant turns out 100 tons of CO_2 per day. Plant operation is almost entirely automatic.

A large percentage of the major processing equipment is devoted to efficient heat transfer. Among these are eighteen custom-made heat exchangers and condensers manufactured by Vilter. Typical units include: Shell and Tube type ammonia-cooled condensers, Shell and Tube type water-cooled vapor cooler (all aluminum construction), liquid receivers, aftercoolers, condensers, oil separator, flash intercoolers, and ammonia surge drum among others. The largest Vilter unit supplied provides a heat dissipation capacity of 2,242,000 BTU per hour.

Vilter has successfully resolved many problems of cooling under both low and intense pressures; and has designed and produced hundreds of heat exchangers, pressure vessels, and high pressure synthesis condensers to exacting specifications for many types of chemical and petroleum applications. Vilter heat exchangers are efficient, reliable, and thoroughly inspected and tested prior to shipment.

Consult with Vilter about your heat exchanger needs.

Write for these helpful bulletins to The Vilter Manufacturing Company, Dept. K-808, 2217 S. First Street, Milwaukee 7, Wisconsin

Bulletin 817
Vilter VMC
Ammonia
Compressor

Bulletin 707
Vilter Condensers
Brine Coolers
Heat Exchangers

Bulletin 427
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REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

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One operater with very little training
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with throughput up to 2 tons an hour . . .
for only .06 to .1 cent a pound.

16 tons for $32

CEC high vacuum stills cut process cost

Now, for less than 1/10 cent a pound, you can separate tall oil, vitamin concentrations, plasticizers, waxes . . . hundreds of other organic and silicone compounds in the 250 to 4000 molecular weight range.

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Write for High Vacuum Still Bulletin 3-1 . . . and for details on test runs of your samples.

Rochester Division CEC

CONSOLIDATED ELECTRODYNAMICS/rochester 3, new york

LITERATURE . . .

Conveyors, Pneumatic.....Bulletin No. P58-G contains complete information on pneumatic conveyor systems for handling dry granular materials.
143 *National Conveyors Co., Inc.

Materials Handling.....Bin-Dicator prevents bin overflow, conveyor clog, elevator choke-up, machinery damage, repair shut-down. Catalog BD-15 offered.
TL231 *The Bin-Dicator Co.

Materials Handling.....The self-loading Dumpmaster handles 6 sizes of containers. One-man operation ...can't injure operator. Brochure is offered.
120 *Dempster Brothers

Materials Handling Fan.....for handling dust, chips, grains & fibrous materials in any process...also in a variety of types for ventilation & other processes.
R235 *Westinghouse Electric Corp.

Overhead Materials Handling.....Revised "Engineering and Application Data" covers various carriers, cranes, track switches, etc. for overhead materials handling.
224A Cleveland Tramrail

Payloader.....The H-25 feature maneuverability & speed with 2,500 lb. carry capacity. Facts about the H-25 Payloader and other Payloader models is available.
46 *The Frank G. Hough Co.

Portable Platform Scale.....reads quickly & clearly, moves easily through narrower aisles and stays accurate & sensitive under roughest conditions. Model 1124-A. Cat. 205
*Fairbanks-Morse & Co.

Spiral conveyors.....Complete range of types—sectional spirals, ribbon conveyors, cut flight conveyors, etc. For details write for Catalog 951.
48 ***The Jeffrey Manufacturing Co.**

Heating & cooling

Graphite Heat Exchanger.....Bulletin uses photos, drawings and chart to describe Impervite modular exchanger system for heating or cooling corrosive fluids.
224B Falls Industries, Inc.

Heat Exchangers.....Information on application, installation & operation of standard plate, bayonet, & coil type exchangers plus circulation steam jets in Cat. S-6620.
122 *National Carbon Co.

Heat Exchangers.....Brazed Aluminum heat exchange equipment is lightweight, compact-pact 450 sq. ft. of heat exchange surface in 1 cu. ft. Information available.
14-15 *The Trane Co.

Heat Transfer.....Multi-Zone Plate-coil provides for higher pressure containment & a margin of heat transfer capacity. Bul. P61 for complete data & performance.
106 *Tranter Manufacturing Inc.

Heater, Hi-Turbiant.....Illustrated Bul. HT-100 gives detailed data & shows typical systems. Two fields of application; heating transfer fluids & direct firing.
181 *Western Precipitation Corp.

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CIRCLE code numbers for more information. (This Sept. 21 issue card will expire Dec. 21, 1959.)

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1	28	45	66	94C	105	125-126b	144d	188	201	207-208b	L215e	BL221	TL231	BL237
2	29	46	68a	95	106	125-126c	144e	189	201A	207-208c	R215	R221	BL231	R237
4	30	47	68b	96A	107-108	127	144f	190	201B	207-208d	216	222	R231	L238
6-7a	31	48	70-71	96B	109	128	144g	191	202	207-208e	216A	222A	232	R238
6-7b	32	49	73	96C	110	129a	144h	193	202A	209	217	TL223	232A	238A
6-7c	33-34	50	75a	96D	111	129b	144i	194a	202B	210	217A	BL223	TL233	238B
8-9	35a	51	75b	96E	112	129c	161	194b	203	211	217B	R223a	BL233	L239
12-13	35b	52	75c	97a	113	129d	163	194c	203A	212	217C	R223b	R233	R239
14-15	35c	53	75d	97b	114	130	165	195a	204	L213a	218	R223c	234	L240
16-17	35d	54	79	98A	115	131	167	195b	204A	L213b	218A	224	234A	R240
18-19	35e	55	81	99	116	133	169	195c	204B	L213c	218B	224A	234B	240A
20-21a	36	56	83	100A	117	134	171	196	204C	L213d	218C	224B	234C	248
20-21b	37	57	85	100B	118	135	173	197	205	R213	218D	228	TL235	249
20-21c	38	58	91	101	119	140	175	R197a	205A	214a	218E	228A	BL235	250a
20-21d	39	59	92A	102A	120	141	177	R197b	205B	214b	219	TL229	R235	250b
20-21e	40	61	92B	102B	121	142	179	R197c	205C	L215a	219A	BL229	236	250c
22-23	41	62	92C	102C	122	143	181	198	205D	L215b	219B	R229	236A	251
24-25a	42	63	93	102D	123	144a	183	200	206	L215c	220	230	236B	252
24-25b	43	64	94A	102E	124	144b	185							

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8-9	35a	51	75b	96E	112	129c	161	194b	203	211	217B	R223a	BL233	L239
12-13	35b	52	75c	97a	113	129d	163	194c	203A	212	217C	R223b	R233	R239
14-15	35c	53	75d	97b	114	130	165	195a	204	L213a	218	R223c	234	L240
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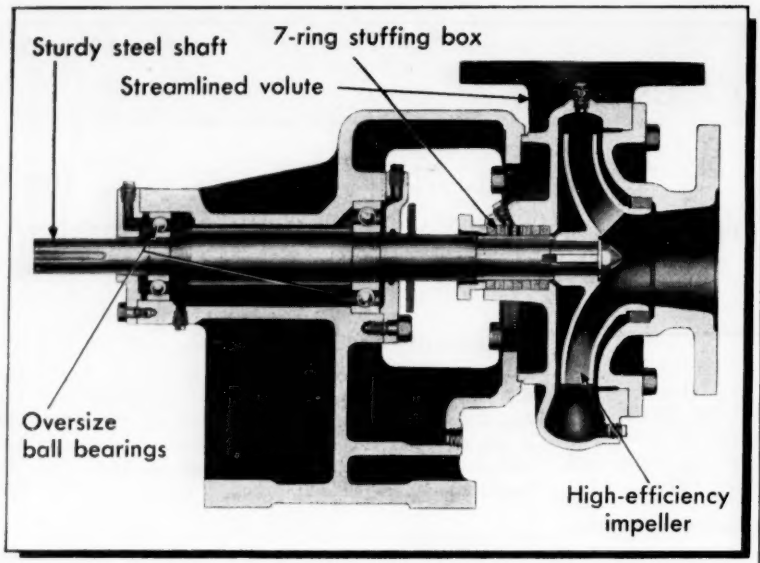

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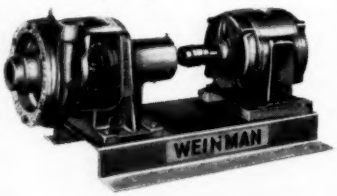
Weinman single-stage, end-suction pumps are available in 10 to 2000 GPM capacities. Write us for descriptive literature, or better still, call your Weinman Pump Specialist. He's listed in the Yellow Pages.



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L238 *Kennedy Van Saun Corp.

Kilns, Rotary.....with the design and perfection of the easy aligning, single roller supports. Further details available in Bulletin No. 1115. tails available on request in Bulletin No. 1115.
32 *Traylor Engineering & Mfg. Co.

Plate Heat Exchanger.....The De Laval Plate Heat Exchanger is constructed of Type 316 stainless steel. It is cleaned after each run by flushing in place.
6-7b *De Laval Separator Company

Steam Generation.....Engineering advances can save you money if you have a steam generating problem. Engineering staff is available to give advice.
161 *Henry Vogt Machine Co.

Steam Trap.....The 48-page Book contains additional information on trap capacity ratings, plus data on how to correctly size, install & maintain steam traps.
116 *Armstrong Machine Works

Steam Trap.....combined with fine screen strainer for all types of steam equipment. All the details are contained in the Steam Trap Book.
L240 *Yarnall-Waring Co.

Instruments & controls

Control.....Complete specifications available in FultroLectric Bulletin RC-756 on new series of pressure and temperature controllers. Send for your copy.
97b *Robertshaw-Fulton Controls Co.

Computers.....The LGP-30 provides fast, accurate answers in all types of statistical studies...analysis of variance, regression analysis, etc. Information & specifications.
133 *Royal McBee Corporation

Control.....Fultromatic combines controller, positioner, valve...gives precise control of temperature or pressure. Complete details in Bulletin RC-755.
97a *Robertshaw-Fulton Controls Co.

Control.....Handbook, "Modern ph and Chlorine Control" is offered. Gives theory and application of ph control. Illustrates & describes full line.
L213a *W. A. Taylor & Co.

Control Cabinet.....engineered for installations where a single unit must provide varying degrees of conditioned air for several zones or rooms.
40 *Buffalo Forge Company

Controls, Temperature.....Get response to temperature changes of ½°F. Change control settings simply by turning one knob. Details available.
58 *Sarco Company, Inc.

Cyanide Analyzer.....Continuous determination of cyanide concentration in liquids or gases via automatic equipment is reviewed in new methodology sheet. 2 to 900 ppm.
228A Technicon Controls, Inc.

* From advertisement, this issue

Protects Metals Against Hot Acids, Acid and Sulfurous Fumes, Salt Spray, Steam, Mild Alkalies, Up to 600° F.

Markal "D-A" Coatings will protect metal against any corrosive action. It is an ideal product for ore sintering plants, plating plants, food plants, lumber kilns, foundries, chemical plants, sewage disposal plants, laundries, heat exchangers . . . many others.

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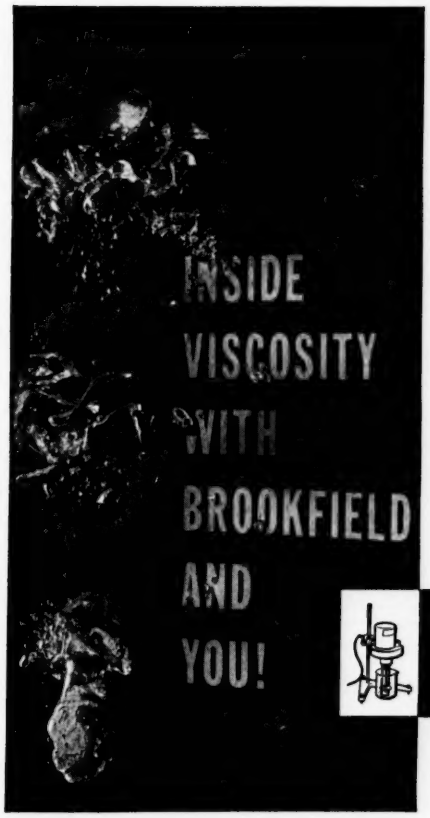

Right to the heart of this vital product dimension . . . that's where Brookfield can take you. Consider this an invitation to ask Brookfield to bring you up to date on how viscosity control, through Brookfield instrumentation, can be profitably applied to your processes. Viscosity measurement, recording and control can now be accomplished automatically for practically any fluid material. Low investment Brookfield portable and process-mounted instrumentation now plays a major role in practically every phase of chemical processing and research.

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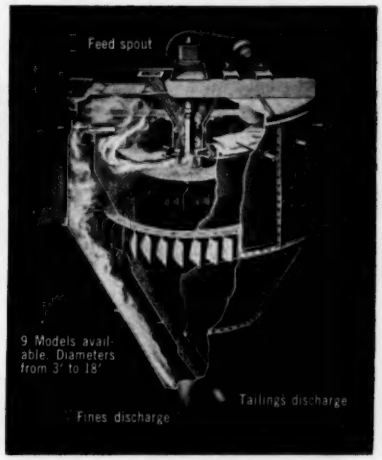
Sturtevant Air Separators Increase 40 to 400 Mesh Output as Much as 300%



Closed-circuit air separation is of proved advantage in reduction processes. Result is a better, more uniform product. Grinding mills perform at top efficiency, output frequently increases as much as 300%, power costs drop as much as 50%.

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Improve screening — Sturtevant Air Separators prevent blinding by removing undesirable tailings *or* fines from screen feed loads.

Works Like Winnowing Done in a Whirlwind

Sturtevant Air Separators do a mechanical job of winnowing. Precise control of whirlwind air currents and centrifugal force results in the desired size being lifted into fines cone, oversize falling into tailings cone.

A 16 ft. Sturtevant, for example, has taken a feed rate of 800 tph, containing only a *small* percentage of desired fines, and delivered 30 tph 90% 200 mesh, recirculating the oversize through the grinding circuit.

Send for Bulletin No. 087.

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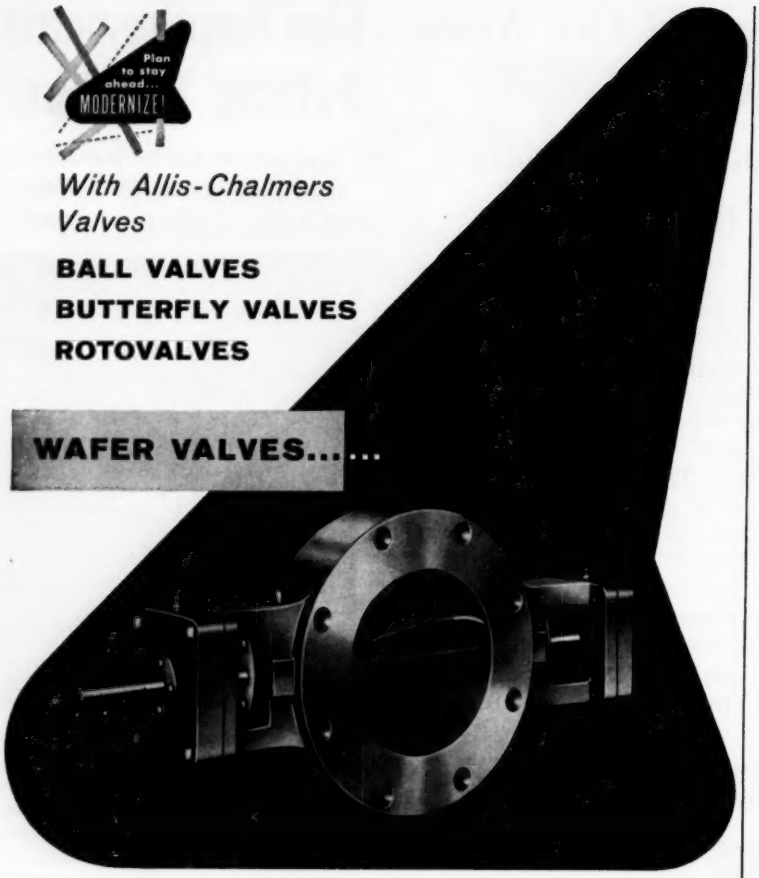

Here's a new wafer valve—with Allis-Chalmers full-bodied design—that incorporates many of the highly-desirable features of two-flanged butterfly valves.

Rugged Construction—A-C full-bodied design affords full protection; there is no chance of cracking around bolt holes. Vanes are pinned to stainless or monel shafts with high-tensile pins. Oversized outboard roller bearings and retaining plates are used. Rugged standard mounting brackets provide maximum support for any operator in any position.

Flexibility—Valves can be provided in a wide variety of alloys to handle all types of fluids and semi-solids over a wide temperature and pressure range. They may be equipped with almost any operator, which may be mounted in several positions on standard A-C bracket assemblies.

Through Rubber Seats—Full rubber seats on A-C Wafer Valves afford maximum body protection and positive, bubble-tight shutoff. Standard seats are of natural gum rubber, neoprene or hycar. Other materials are available on request.

Size Range—Full-bodied A-C Wafer Valves are available in standard sizes from 3 to 36 inches in both 125# and 150# A.S.A. series, rated as shutoff pressure of 50# and 125#.

For information on the complete line of Rotovalves, and butterfly, ball and wafer valves, contact your nearest A-C valve representative, or write Allis-Chalmers, Hydraulic Division, York, Penna.

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Gauges.....High pressure gauges used in Refineries & Chemical Plants throughout the world. Complete catalogue on large chamber reflex gauges & heated or cooled gauges.
188 *Strahman Valves, Inc.

Indicator.....The Level-Tel 154 is a precise, continuous reading level indicating system consisting of a probe detector, transmitter, and indicator.
179 *Robertshaw-Fulton Controls

Instruments.....Tankometer for measuring tank contents any distance away. Also gauges for Barometric Pressure, Absolute Pressure, Pressure & Vacuum, etc. Bulletins.
BL223 *Uehling Instrument Co.

Leverage System.....Controls processing or materials handling by weight. Literature on its application to filling, batching & check-weighing operations is available.
209 *Thayer Scale Corp.

Magnetic Flow Meter.....industry-wide application for precise, linear measurement of difficult process liquids. Write for Bulletin 20-14C for more information.
79 *The Foxboro Company

Pointer Gages.....Complete information on a line of pointer and indicator gages is contained in a series of product specification sheets. For pressure measurements.
230A Hays Corp.

Transmitters.....Two new f/b line models permit new accuracy in measuring flow & differential pressure. Applications for steam, air, gases, water, etc. Information.
114 *Bailey Meter Co.

Pipe, fitting, valves

Connectors, Electrical.....for use in laboratories, factories, classrooms, etc. Request SUPERCON Bulletin for full technical information. Send for your copy.
33-34 *The Superior Electric Company

Control Valves.....with an extremely high rangeability, providing a wider control range. Complete story on control valves available in Bulletin No. 150.
50 *DeZurik Corporation

Control Valves.....Such features as welded-in, solid stellite guide bushings, stellited guide posts, etc. Complete details available in new Catalog C800-1.
56 *Minneapolis-Honeywell

Expansion Joints.....The Expansion Joint Design Guide features 28-pages of valuable information on expansion compensators, flexible connectors, etc.
105 *Flexonics Corp.

Expansion Joint.....Teflon expansion joint molded of Fluoroflex-T outlasts most other materials & constructions. Offers high tensile strength. Bulletin B-1A.
121 *Resistoflex Corporation

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36 *Titeflex Inc.

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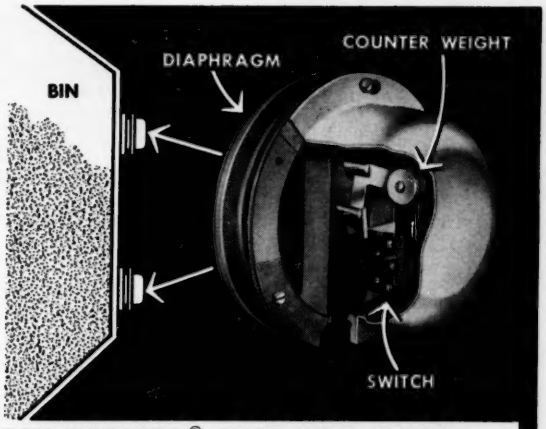

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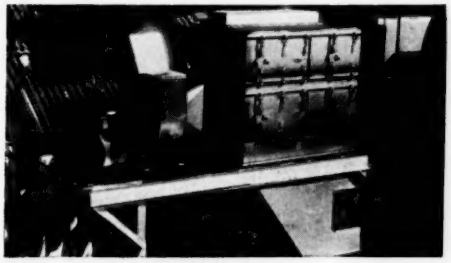

Barely visible discharge from exhauster in this unretouched photo shows how Dustex Miniature Cyclone Collector ended a problem for Perlite Products Co.—while recovering 70 lbs./hr. with no maintenance.

"95% PREDICTED EFFICIENCY PROVED . . .
and Collector is maintenance-free!"

Frank W. Schaffer, President of Perlite* Products Co., Primos, Pa., writes this about his Dustex Miniature Cyclone Collector purchased on a basis of the Dustex Single Tube Determination test:

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**Perlite . . . extremely lightweight material for insulation and filtration, with a bulk density as low at 3.5 lbs./cu. ft.*

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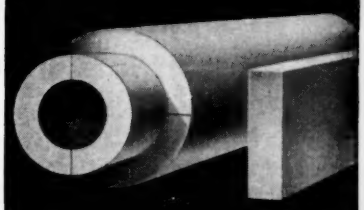
ONE-LAYER INSULATION!

Now a modern molded calcium silicate insulation for use on today's high temperature pipes and vessels. Insulates with only *one* layer, providing a constant co-efficient of conductivity. Available in various thicknesses of pipe coverings and blocks, Calsilite is insoluble in water, can withstand normal acids and alkalis . . .

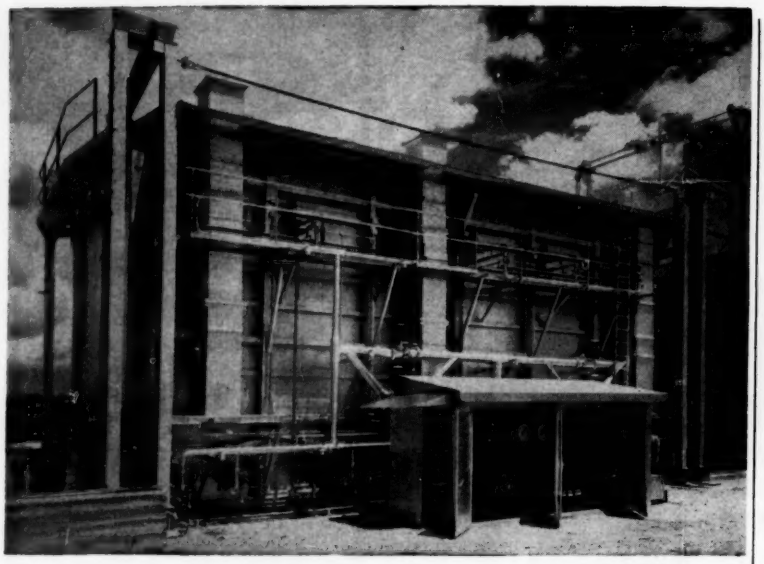


FOR SOAKING HEAT UP TO 1250° F!

- Light weight
- Resists abuse
- Easy to cut and mitre
- One layer does the complete job
- Absorbs moisture without disintegration

For complete details, see Chemical Engineering Catalog or Sweet's Catalog.
Send your inquiry to:

The RUBEROID Co.®
INDUSTRIAL PRODUCTS DIVISION
500 Fifth Ave., N. Y. 36, N. Y.
PIONEERS IN CALCIUM SILICATE INSULATION



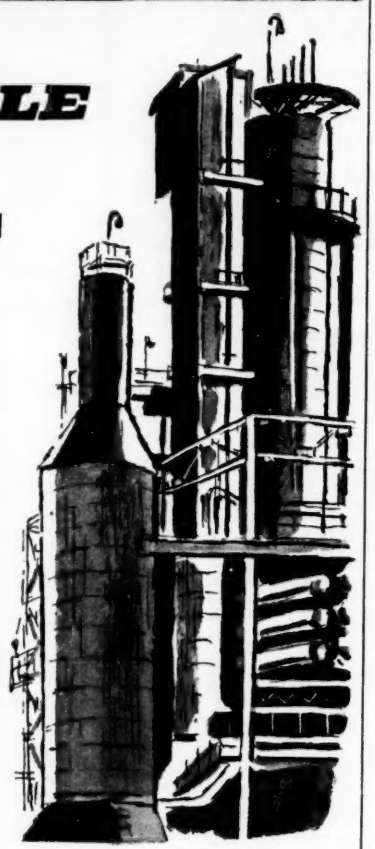
AVONDALE

a new name in the chemical field

NEW FACILITIES . . . at Avondale Marine Ways now make it possible to offer a wide range of products and services directly to the chemical and petrochemical industries. In addition to large plate rolls for heavy steel fabrication, there is the specially designed, automatically controlled furnace with temperatures up to 2100°F. shown above.

Through the use of these facilities, Avondale can produce ASME Code Stamped pressure vessels to 4 in. thickness and up to 18 ft. in diameter and 300 ft. in length.

Write for our complete brochure, *Heavy Steel Fabrication*



Industrial Division
AVONDALE
MARINE WAYS, INC.
VERSATILE BUILDER ON THE MISSISSIPPI
416 ERATO ST. • JAckson 2-3836 • NEW ORLEANS 13, U.S.A.

LITERATURE . . .

Hose.....TFE resins are rated for continuous use up to 500°F.; they are unaffected by virtually all acids and solvents. Details available upon request.
37 *E. I. du Pont de Nemours & Co.

Pipe.....All-purpose rigid PVC in schedules 40, 80, & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". Bulletin CE-56, for details.
195c *American Hard Rubber Co.

Pipe.....Tempron non-metalic pipe for hot chemicals to 275 F. Also handles tough organics. Rigid tough nitrile. Pipe & fittings to 8". Bul. 96A.
194a *American Hard Rubber Co.

Pipe, Plastic.....Flexible poly pipe is ideal for water lines, drains, underground pipe or conduit. In sizes ½ to 2", long coils. Details in Bul. CE-57.
195b *American Hard Rubber Co.

Pipe, PVC.....performance data is available on corrosion resistance, allowable stress, temp., pressure, impact, vibration, etc. New 32-page illustrated catalog offered.
53 *A. M. Byers Co.

Piping Standards....."Recommended Practice for Permanently Affixing Identification Symbols to Fabricated Piping", an advisory bulletin, is available at no cost.
232a Pipe Fabrication Inst.

PVC Pipe.....is lightweight, resists acids, corrosion, aging, weather & abrasion. It will not support combustion, is an excellent insulator. Details.
1 *B. F. Goodrich

Plastic Pipe.....If you are confused about the use of plastic pipe, write for details about which pipe to use. Uscolite Pipes cover all requirements.
187 *United States Rubber

Spray Nozzle....."Cant-Clog" spray nozzle is now available as a replacement on all makes of spray equipment...as caps only or complete nozzles. Information.
L239 *Carrier Corporation

Tube Expanders.....New tube expanders roll tubes into thick sheets in one pass. Bul. Y-52 outlines the complete line of retubing accessories plus tube expanders.
219 *Elliott Co.

Tubes, Condenser.....The new edition of Publication B-2 gives complete information and technical assistance in the selection of the alloy to give the best service.
62 *The American Brass Co.

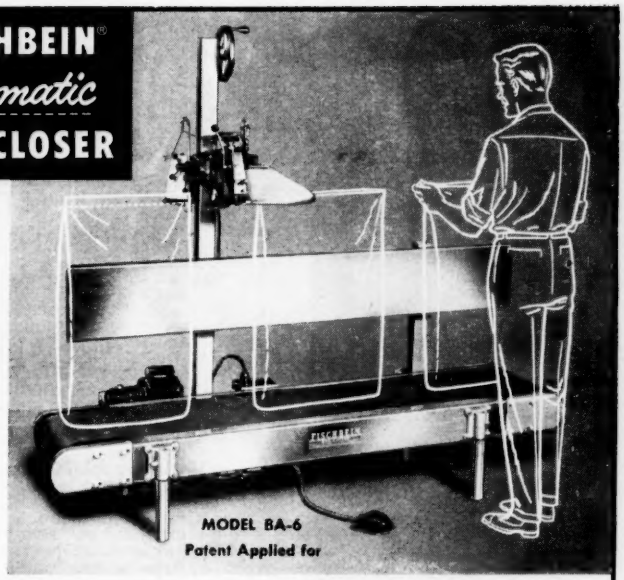
Tubing.....Lectrosonic designed to meet need of petrochemical industry for electric resistance welded carbon steel that is easily workable, strong, etc. Bul. TB-431.
140 *Babcock & Wilcox Co.

Tubing.....Ace-Flex is non-toxic, odorless, tasteless, sterilizable, flexible tubing. Excellent for chemicals, foods, and for lab or machine lines. Bul. 66.
194c *American Hard Rubber Co.

Tubing Inspection.....Write for bulletin describing operation, range of sensitivity, advantages, and general background on Damascope testing. Send for your copy.
109 *Damascus Tube Company

* From advertisement, this issue

FISCHBEIN® *Automatic* BAG CLOSER



Large Plant Production! Small Plant Price!

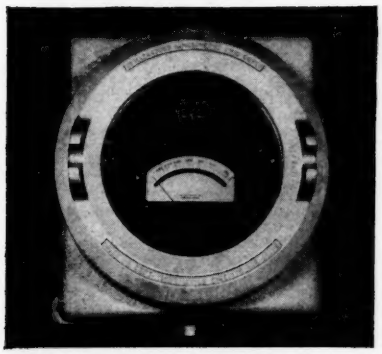
- **Bag activates and completes sewing operation automatically!**
- **Simple mechanical operation . . . Simple installation.**
- **Sews at rate of 30 feet per minute!**

An automatic closing unit. The bags themselves start the sewing operation when they reach the sewing head. After sewing is completed, thread is cut automatically and sewing action stops as conveyor belt continues to move bag.

Write for details and complete catalog-file of Fischbein Bag Closing Equipment.

DAVE FISCHBEIN CO. DEPT. 3C
2720 30th Ave. South, Minneapolis 6, Minn.

HASTINGS GAS FLOWMETER



Model FI-6 Indicator in explosion-proof case.

Type S-16B Gas Flow Probe

RANGE AND CALIBRATION — The indicator is furnished with a linear scale from 0-200. Calibration curves are available for air over the range from 25-6,000 feet per minute at S.T.P. or from 2-450 pounds per minute per square foot of cross sectional area. The greatest accuracy, however, is in the lower portions of these ranges, principally, from 75 to 1,000 feet per minute at S.T.P., and from 4 to 75 pounds per minute per square foot of cross sectional area. Calibration curves can be determined for most other gases and gaseous mixtures.

UL

APPROVED FOR Class 1, Group D HAZARDOUS LOCATIONS

This electrical instrument is the first of its type to be UL approved for use in the presence of certain flammable and explosive mixtures, Class 1, Group D. Indicator furnishes continuous, direct indication of mass flow in gas lines. 115-Volt 60 Cycle operated.

- EASILY INSTALLED — No orifices, Flanges or By-Pass Required.
- NO CORRECTIONS needed to compensate for temperature or pressure variations.
- CONTINUOUS DIRECT INDICATION.
- EXTREMELY SENSITIVE. Can even detect leaks in valves and control units.

HASTINGS-RAYDIST, INCORPORATED
HAMPTON 1, VIRGINIA

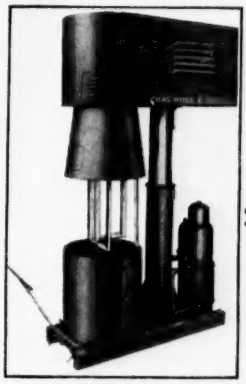
FOR PROPELLANT___ OR PLASTISOL*

ROSS DOUBLE PLANETARY
Change Can Mixers give better mixing in less time!

At *Thiokol*® solid propellant plant in Elkton, Md., this Ross #130CDM variable speed 100 gallon Mixer produces the **same high quality mix as obtained in Horizontal Double Arm Kneaders, and in ⅓ the mixing time.**

With no bearings or stuffing boxes in the product zone, stationary can, completely enclosed mix, and remotely controlled raising and lowering device, the Mixers are as safe in operation as they are efficient. Mixers have low original and maintenance cost, are easy to clean, and extremely versatile in operation.

Lower illustration shows an 85 gallon #130-CDM Double Planetary Change Can Mixer furnished a leading concern for mixing plastisols of several types ranging up to 200,000 centipoises. Customer reports Mixer in operation 24 hours/day with mixing time per batch only 15-20 minutes; while the quality of mix and dispersion is so high that the final product is obtained in the Mixer alone — without further processing through a Three Roll Mill as was previously necessary with other Mixers.



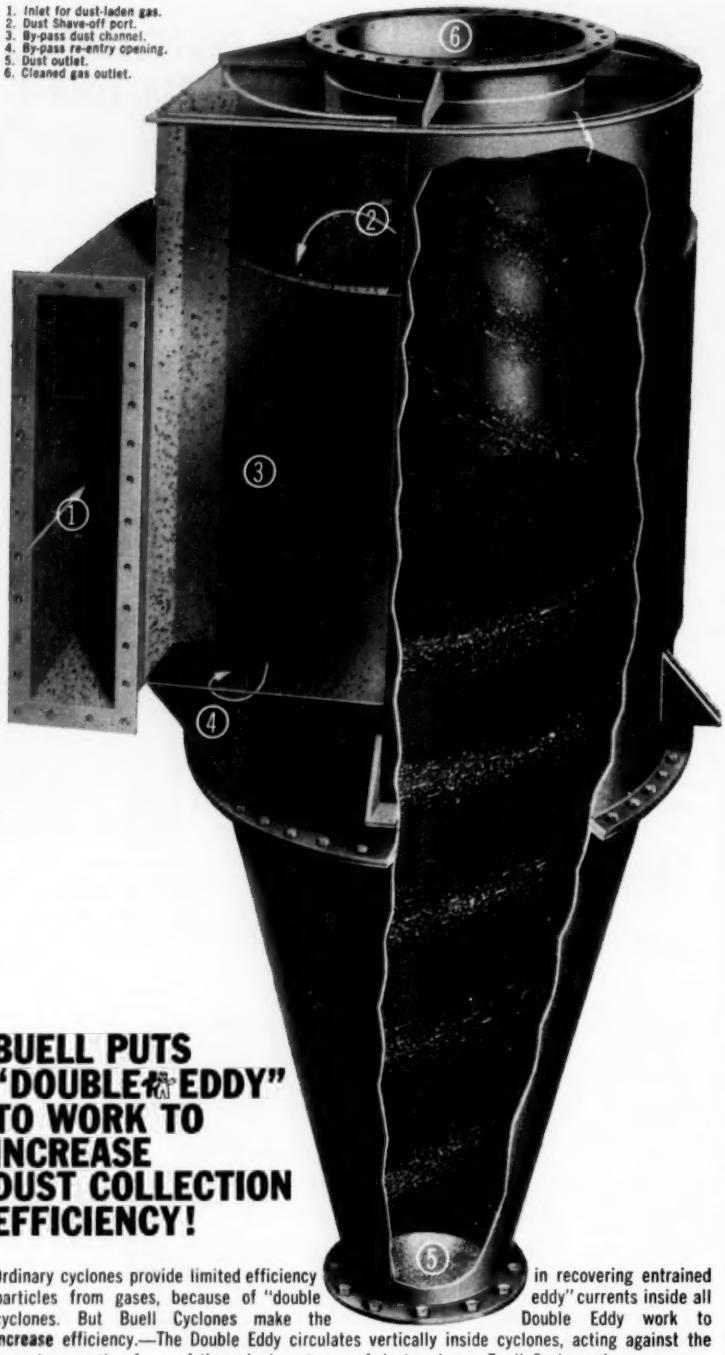
Jacketed cans for heating or cooling material during mixing, dolly trucks, gates on cans for discharge, and vacuum tight covers can be provided.

*---or any other heavy paste material. On paints, inks, pharmaceutical products, caulking compounds, and other similar materials, the Ross Double Planetary Change Can Mixers mix and disperse up to 30 times faster than other Mixers.

Mixers available in 1, 2, 3, 4, 6, 8, 12, 20, 25, 65, 85, 125 and 150 gallon sizes. *Write* for complete information on these or other types of Ross mixing, grinding or dispersing equipment!

CHAS. ROSS & SON CO., INC.
Leading mfgrs. of wet or dry grinding Mills, Kneaders and Mixers of all types — since 1869.
150 Classon Avenue, Brooklyn 5, N. Y.

1. Inlet for dust-laden gas.
2. Dust Shave-off port.
3. By-pass dust channel.
4. By-pass re-entry opening.
5. Dust outlet.
6. Cleaned gas outlet.



BUELL PUTS "DOUBLE EDDY" TO WORK TO INCREASE DUST COLLECTION EFFICIENCY!

Ordinary cyclones provide limited efficiency in recovering entrained particles from gases, because of "double eddy" currents inside all cyclones. But Buell Cyclones make the Double Eddy work to **increase** efficiency.—The Double Eddy circulates vertically inside cyclones, acting against the normal separating force of the spinning stream of dust and gas. Buell Cyclones have a narrow "Shave-off" port (2) at the top of the casing. This port catches and removes dust trapped in the Double Eddy. It makes the cyclone **more** efficient instead of less.—This is one of the reasons Buell has more experience with fluid bed catalyst recovery, for example, than all other manufacturers combined.—Only Buell Cyclones combine this high efficiency with large diameter. They will not clog or plug even with dust loadings up to one pound per cubic foot of gas. They can be made of any material. They can be completely lined, inside and out, against heat, corrosion and abrasion. No field fitting is needed: they are completely assembled and match-marked before shipment.—For a list of installations near you, a copy of our Catalog 103, or other information, call our nearest representative, listed in the telephone classified directories of most major cities under "Dust Collection Systems". Or write Dept. 12-I, Buell Engineering Co., Inc., 123 William St., N. Y. 38, N. Y. (Subsidiary: Ambuco Limited, London, England.)

EXPERTS AT DELIVERING EXTRA EFFICIENCY IN DUST RECOVERY SYSTEMS: CYCLONES—"SF" ELECTRIC PRECIPITATORS—COMBINATION SYSTEMS—DRY CLASSIFICATION SYSTEMS.

buell®

LITERATURE . . .

Tubing Stainless Steel.....Welded stainless steel tubing resists corrosion, high temperature and contamination. Complete details on this tubing in Bul. 8591.
175 *Formed Steel Tube Institute, Inc.

Valves.....Series TA valves for refineries, petrochemical & chemical processing plants. Catalog covers Globe & Angle valves, screwed or flanged types.
234A The Bastion-Blessing Co.

Valves.....A complete line of pneumatic control valves—diaphragm or piston operated, split or integral bodies for every application. Hammel-Dahl Catalog.
75a *General Controls

Valves.....Long line of heavy duty steam reducing valves, regulators, high pressure safety valves. Further information contained in Foster Catalog.
75b *General Controls

Valves.....By combining the powerful electro-hydraulic operators with a variety of valve bodies, the Hydramotor offers tremendous power. Hydramotor Catalog.
75d *General Controls

Valves.....Dependable performance and long service life for vacuums down to 0.1 micron...with leak rates of less than 0.1 micron cubic foot/hour. Details.
38 *Grinnell Company

Valves.....Folder No. 202-A describes Plug Type Bronze Valves. Many features including; perfect grip handwheel, full length pipe threads, extra heavy bronze body, etc.
117 *Jenkins Bros.

Valves.....available in the largest selection of metals and alloys to handle practically every corrosive fluid. Write for more information on valves.
65 *The Wm. Powell Company

Valves, Chlorine.....now in sizes up to 6". For all water-free chlorine gas or liquid services up to 300F. Ideal for chlorinating lines in chem. processing, etc. Specifications.
141 *Crane Co.

Valves, Cylinder.....Designed for use with a wide variety of compressed gases including those which are normally compressed to the 2000-3000 psi range. Catalog.
234B The Bastion-Blessing Co.

Valves, Gate.....for high pressure corrosive service. Different designs for every size requirement. Bul. No. 7 gives complete information for specific corrisive service.
R240 *Alloy Steel Products Co.

Valves, Gate.....avoid leaks & process interruptions. Cat. 57 outlines sizes, types & metals of various alloys for all kinds of normal & unusual service.
222 *Darling Valve & Mfg. Co.

Valves, Shut-Off.....for use in hospital & industrial piping systems where gases are supplied from a central bank of cylinders to branch outlet throughout system. Bul.
234C The Bastion-Blessing Co.

Valve, Wafer.....available in standard sizes from 3" to 36" in both 125# & 150# A.S.A. series, rated as shutoff pressure of 50# & 125#. Information on complete line.
230 *Allis Chalmers, Hydraulic Div.

* From advertisement, this issue

ROLOCK

SPECIALIZED WELDED HEAT AND CORROSION RESISTANT **FABRICATIONS**

for example

VACUUM RETORTS

This heavy INCONEL Vacuum Retort is one of a number of such designs being produced by ROLOCK. Approximately 2 feet in diameter by 8 feet high, it is used for high-temperature vacuum annealing.

By entrusting such work to ROLOCK, you gain the many advantages of competent engineering supervision; production personnel thoroughly experienced in the problems and materials involved; a modern plant fully equipped for inspection and testing as well as fabrication.

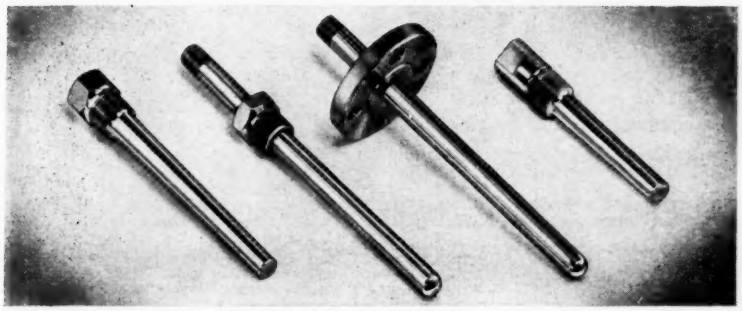
Rolock facilities and skills cover a wide range of work in pressure and vacuum equipment, specialized processing carriers, furnace retorts, covers and bells, trays, tanks, fabrications and assemblies in Inconel, Incoloy, Monel, the Hastelloys, and Stainless Steels. Send us an outline of your requirements.

Put your problems up to:

3RL.58B

ROLOCK INC., 1340 KINGS HIGHWAY, FAIRFIELD, CONN.

To Be Sure...Choose *Thermo Electric* Thermowells



Solve your thermowell problems!
Temperature, Environment, Installation.

Choose from over 5700 standard designs. You have a complete selection of materials to withstand oxidation, reduction, high temperature, chemical corrosion, and mechanical and thermal shock conditions. Bar-stock and built-up wells are available with your choice of mounting flanges and bushings. Many types in stock.

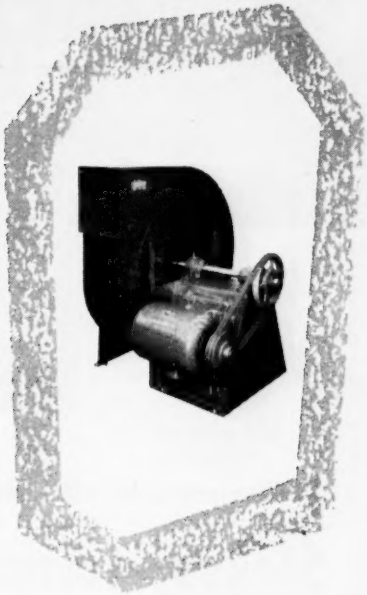
All wells are pressure tested to 3000 psi. X-rays can be furnished when required.

Send today for your Thermowell Catalog and Materials Application Guide, EE

Thermo Electric CO., INC.
SADDLE BROOK, NEW JERSEY

In Canada:
THERMO ELECTRIC (Canada) LTD.,
Brampton, Ont.

NEED A MATERIALS HANDLING FAN?



READILY AVAILABLE:

WESTINGHOUSE RUGGED, VERSATILE FANS for handling dust, chips, grains and fibrous materials in any process . . . also in a variety of types for ventilation and other processes.

Call your nearest Sturtevant Division Sales Engineer—or write Westinghouse Electric Corporation, Dept. J-13, Hyde Park, Boston 36, Mass.

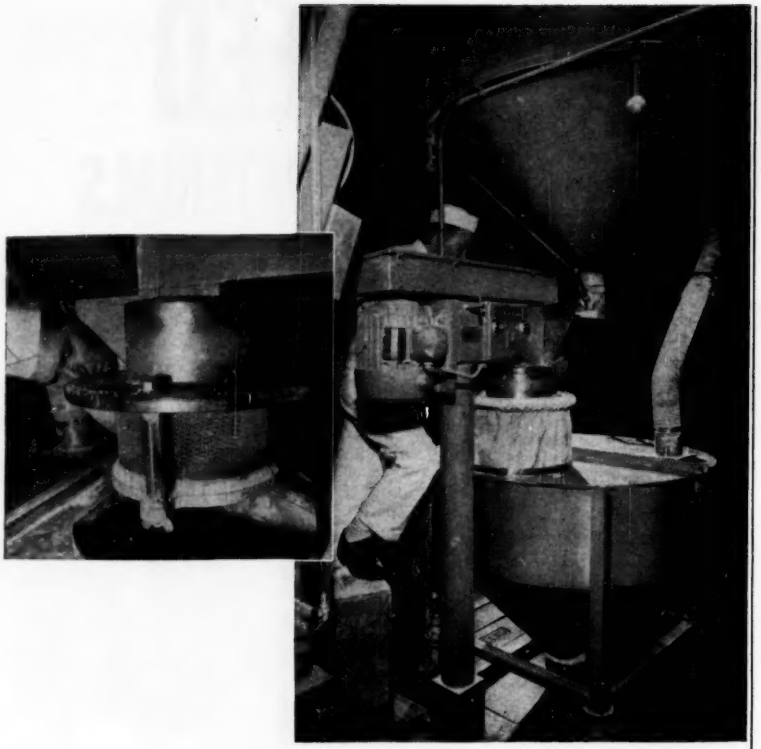
J-80690

YOU CAN BE SURE...IF IT'S

Westinghouse

Plants at Hyde Park, Massachussets; La Salle, Illinois; Berkeley, California.

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS



At Warner-Chilcott Laboratories

Stokes "Tornado" Mills raise efficiency, lower costs

Two Stokes "Tornado" mills installed at Warner-Chilcott Division of Warner Lambert Pharmaceutical Co. are paying big dividends in the preparation of Gelusil, an antacid, absorbent tablet. For example:

- "Tornado" mills consume less power (a 7½ hp motor does same work as unit with 15 hp motor)
- larger production capacity is obtained by durable, non-clogging 360° screens
- unique design insures excellent uniformity, minimizes "fines", actually doubles efficiency of drying ovens

Why not find out how the Stokes "Tornado" mill can increase the efficiency of your operations. The Stokes Advisory Service will be glad to run tests on a sample of your material . . . at no obligation. Call or write Stokes . . . today.

Pharmaceutical Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

LITERATURE . . .

Valves, Plug.....are available in semi-steel, Ni-resist, carbon steel, bronze & aluminum. Lubricant protects against corrision. Details in Catalog 400.
45 *W-K-M Div. of ACF Industries

Process equipment

Air Separators.....Nine models available with diameters from 3' to 18'. Feature precise separation and improve screening. Information in Bulletin No. 087.
R229 *Sturtevant Mill Co.

Centrifuges.....The De Laval Gyro-Tester, only slightly more than 18" high, thoroughly clarifies up to 25 gallons of ball-point ink per hour. Information available.
6-7a *De Laval Separator Company

Centrifugals.....features no crystal degeneration. All cycle components are pneumatically operated. Full information contained in Bulletin No. 2775.
249 *The Western States Machine Co.

Crystallizers.....Krystal crystallizers assure product purity, product uniformity, & product quality. Write for all-new descriptive bulletin. Send for your copy.
123 *Struthers Wells Corporation

Cyclones.....will not clog or plug even with dust loadings up to one pound per cubic foot of gas. They can be made of any material. Details in Catalog 103.
234 *Buell Engineering Co.

Dryer.....Complete information on vacuum chamber dryers is available on request. Special dryer designs to solve your chemical processing problems.
TL221 *J P. Devine Mfg. Co.

Filters.....feature small space requirements, constant exhaust volume, and high collection efficiency. More information available on request.
22-23 *American Air Filter

Filters.....Automated features and improved labor-saving design of Eimco-Burwell filters are explained in Bulletin F-2052. Series of drawings explain operation.
236A Eimco Corp.

Filter, Rotary Vacuum.....Data is available on these filters and filters for your individual requirements. Details on size, construction materials, etc.
64 *American Machine & Metals, Inc.

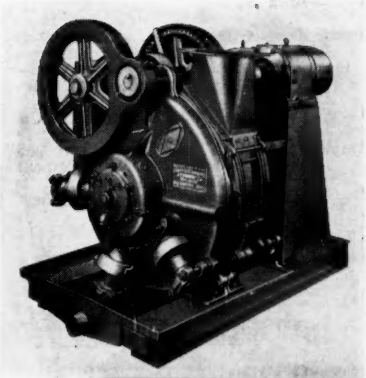
Flash Drying Systems.....Send for bulletin with further details on equipment that handles the material automatically in a clean, dust-free operation.
142 *Combustion Engineering, Inc.

High-Vaccum Stills.....offer high throughput, continuous operation: 4 sizes, from 2 to 4000 pounds per hour. Specifications & application data contained in Bul. 3-1.
224 *Consolidated Electrodynamics

Inert-Atmosphere Generators.....A new bulletin describes a line of packaged inert-atmosphere generators. Typical installations, features and flow chart.
236B Gas Atmospheres, Inc.

* From advertisement, this issue

"DAVENPORT" Continuous DeWatering PRESSES



If you have a problem of dewatering semi-solid material, perhaps you are missing a bet by not investigating the Davenport line of Continuous Dewatering Presses. Laboratory pressing and drying equipment available to provide you with the answers to your problems.

Let our engineers consult with you on your Pressing, Drying and Cooling problems or send for our catalog A. For quick reference consult your Chemical Engineering Catalog.

DAVENPORT MACHINE AND Foundry Company
Davenport, Iowa, U.S.A.

DAVENPORT

PRESSING – DRYING and COOLING Equipment

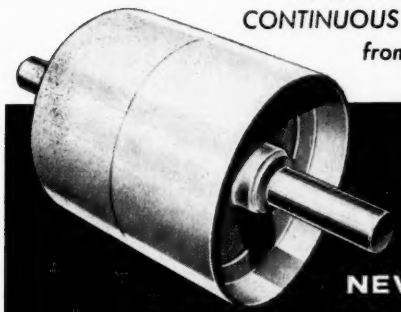
Continuous DeWatering Presses

ROTARY DRYERS
Steam Tube, Hot Air and Direct Fire

Atmospheric DRUM DRYERS

ROTARY COOLERS
Water and Air

The answer to your need for LOW-COST CONTINUOUS SEPARATION of TRAMP IRON from fast-moving deep burdens



DINGS
NEW CERAMIC TYPE PERMANENT MAGNETIC PULLEY

CERAMOX V! That's Dings' new, powerful ceramic magnet material which protects processing machinery from costly tramp iron damage and removes contaminating iron particles from a wide variety of dry, granular chemicals and other materials to assure product purity. Dings' new ceramic radial-pole Perma Pulleys provide high magnetic strength across the entire belt width and greatest removal efficiency from deep burdens at high operating speeds. Other money-saving features . . .

- No operating cost. No wiring or power required.
- No maintenance. Unit is automatic.
- Quickly and easily installed.
- High resistance to demagnetization.
- High and prolonged surface strength.
- Stainless steel surface for all-weather service.

Write today for more detailed information about how Dings Ceramic Perma Pulleys can up-grade products and prevent tramp iron damage in chemical processing operations.

Dings

DINGS MAGNETIC SEPARATOR CO.
4730 W. Electric Ave. • Milwaukee 46, Wis.

Expanding the Frontiers of Space Technology in

ORDNANCE

■ Ordnance plays an important role in contributing to the advancement of missiles and space technology at Lockheed.

Work is being conducted in ordnance in: flight test; environmental test; static test; design; pyrotechnics; fuel development; and instrumentation. Other studies include research and development in destruct systems; stage separations; squibs; flares; switches; timers; ignition; explosive valves, and the problems of altitude, temperatures, humidity, shock, vibration and oscillation affecting the performance of explosives.

ENGINEERS and SCIENTISTS

Lockheed Missiles and Space Division projects and research and development programs reach far into the future and deal with unknown and challenging environments. It is a rewarding future with a company that has an outstanding record of progress and achievement. If you are experienced in ordnance in any of the above areas, or in related work, we invite your inquiry. Write: Research and Development Staff, Dept. I-58, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship required.

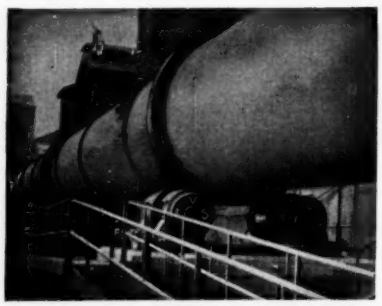
Lockheed
MISSILES AND SPACE DIVISION

Systems Manager for the Navy POLARIS FBM; DISCOVERER, SENTRY and MIDAS; Army KINGFISHER; Air Force Q-5 and X-7

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA
CAPE CANAVERAL, FLORIDA
ALAMOGORDO, NEW MEXICO • HAWAII

KENNEDY ROTARY KILNS *for*

Lime
Calcined Coke
Dead Burned Dolomite
Cement—Wet or Dry Process
Nodulizing and Agglomerating
Drying



Compare these KENNEDY *Features:*

- Self-aligning bearing pedestals.
- Stationary firing hood with swinging entrance ports for quick, easy internal access.
- Truly effective air seals.
- Drive gear mountings avoid thermal stresses.
- Built in any length or diameter.
- Designed to give economical, efficient operation over long periods.

FOR ADDED ECONOMY—Preheaters for your new or existing kilns: KENNEDY Multivane Internal Recuperator—KENNEDY-Grudex Preheater—KENNEDY External Stone Preheater.

Suppliers to the Chemical Industry of crushing, grinding and pulverizing machinery, complete cement and lime plants, size separation equipment and pneumatic conveying components and systems.

KVS

KENNEDY VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
466 Park Ave., N. Y. 22, N. Y. • Factory, Danville, Pa.

LITERATURE . . .

Inert Gas Generators.....stand up under the toughest condtions, yet produce with complete dependability. Complete information in Bulletin I-10.
171 *The C. M. Kemp Mfg. Co.

Impact Mill.....Information on the new Pulver-Mill, a vertical impact mill with integral air classifier is offered by manufacturer. Flowsheet and operation details.
238A Sturtevant Mill Co.

Liquid Nitrogen Generator.....The unit produces an average of six liters of pure, (99.5%) liquid nitrogen per hour over an uninterupted period of up to 200 hrs. Details.
101 *North American Philips Co.

Iagnetic Pulley.....Detailed information about how new Ceramic Perma Pulley can up-grade products & Prevent tramp iron damage in chemical processing operations.
BL237 *Dings Magnetic Separator Co.

Mills.....Complete details on how Tornado Mills can increase the efficiency of your operation is available. Unique design insures excellent uniformity.
236 *F. J. Stokes Corp.

Mills, Reversible Hammer.....with new dual "2-Point" adjustment insures more uniform grinding. Features super-strong reinforced steel plate frame. Facts.
*William Patent Crusher & Pulverizer

Miniature Cyclone Collector.....Bulletin "A Simplified Test Method" describing actual collection test at your plant is available on your request.
BL231 *Dustex Corp.

Mixers.....Complete information on Double Planetary Change Can Mixers and other types of mixing, grinding or dispersing equipment now available.
R233 *Chas. Ross & Son Co., Inc.

Mixers.....Handbook on Mulling reveals how controlled dispersion can be achieved in this era of high purity-high uniformity raw materials. Send for your copy.
39 Simpson Mix-Muller Division

Mixers.....The Imperial for heavy duty kneading & mixing. The Mogul for extra heavy materials, like rocket fuel, pastes, putties, etc. Illustrated bulletins available.
201 *The J. H. Day Co.

Mixers.....The Turbulizer's smooth inner surface with 1/16" clearance paddles assures thorough mixing, eliminates material hang-up. More information on mixers available on request.
99 *The Strong Scott Mfg. Co.

Process Equipment.....Complete service, superior manufacturing capability and economy, on-time delivery. Write for fact-packed folder on process equipment.
85 *Artisan Metal Products, Inc.

Purifiers, Scrubbers.....Catalog for equipment specifiers covers line of purifiers, separators, mist extractors and scrubbers. Code information, guarantees, etc.
238B V. D. Anderson Co.

Safety Heads.....feature unrestricted relief openings, wide rangeability in selection of metals & plastics for disc components & rugged construction. Details.
203 *Black, Sivalls & Bryson, Inc.

* From advertisement, this issue

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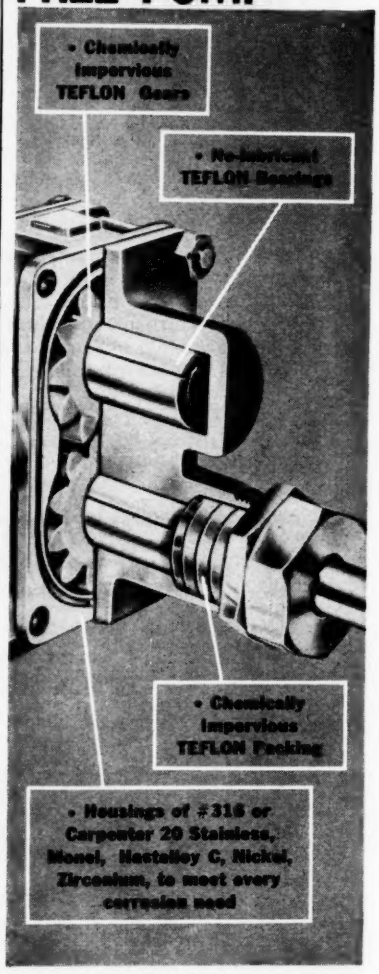
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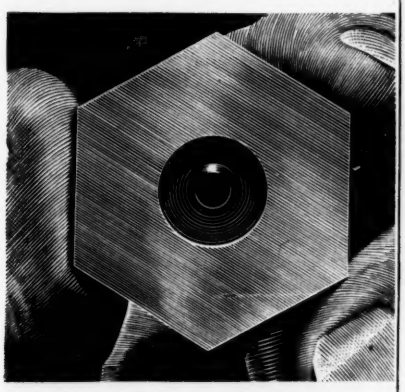

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Carrier

LITERATURE . . .

Separators.....The Syncro-Matic Separator individually controls horizontal, vertical and gyratory motion. Additional information on request.
6-7c *De Laval Separator Co.

Pumps, fans, compressors

Air-Conditioning Systems.....Kathabar systems offer sterile air and dry surfaces as special advantages to specifying engineers. Facts available.
190 *Surface Combustion Corp.

Compressor.....The RX compressor offers continuous compressed air power & requires only routine attention. All information on RX compressors in Bulletin HAC-40.
210 *Gardner-Denver Co.

Lubrication System.....A copy of Bulletion 26-S is now available. It gives a complete rundown on Farval equipment & how it can improve your plant operations.
103 *The Farval Corp.

Pump.....Close-coupled pumps offer capacities to 2500 gpm, heads to 550 ft. Feature Super-Seal motors and heavy-duty construction. Further information available.
193 *Allis-Chalmers

Pump.....offers pumping efficiency with faultless corrosion resistance. Hard rubber casing & impeller. Bul. CE-55 gives the complete details.
195a *American Hard Rubber Co.

Pump, Chemical.....Bulletin 440 contains typical applications, flow charts, descriptions & specifications of Pulsafeeder models of various capacities & construction.
113 *Lapp Insulator Co., Inc.

Pumps.....Motorpumps designed in a wide range of types & sizes to meet requirements in hundreds of varied installations. Complete catalog data on request.
220 *Ingersoll-Rand

Pumps.....New bulletin for evaluating, specifying and servicing pumps for corrosive liquid or slurry handling service. Complete engineering data.
70-71 *Dorr-Oliver Incorporated

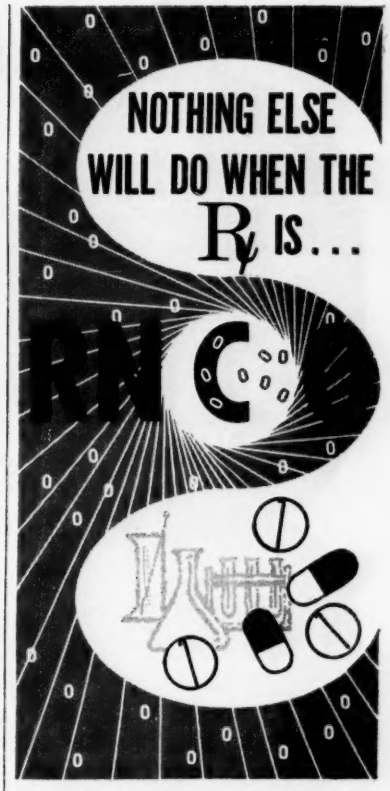
Pumps.....Moyno pumps handle chemicals that ruin other pumps. Bulletin 40 CE contains complete information on how to reduce pumping costs plus other facts.
51 *Robbins & Myers, Inc.

Pumps.....are packingless and maintenance is at a minimum. Highly satisfactory performance. Application advice available upon your request.
54 *The LaBour Company, Inc.

Pumps.....Single-stage, end-suction pumps are available in 10 to 2000 GPM capacities. Descriptive literature outlining all the features is available.
228 *The Weinman Pump Mfg. Co.

Pumps.....Gearchem pumps are completely non-contaminating pumps on all scores—housing, pumping mechanism and lubrication. Literature.
R238 *Eco Engineering Co.

* From advertisement, this issue



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LITERATURE . . .

Pumps, Centrifugal.....Type-R-X Slurry Pump expressly designed to handle abrasive slurries up to the maximum fluid consistency. Details.
59 *Morris Machine Works

Pumps, Glassed.....Descriptive bulletin on glassed pumps is now available on request. Can answer many of your tough slurry-handling problems.
134 *Goulds Pumps, Inc.

Pumps, Turbine.....are most frequently used for: Boiler Feed, Condensate Return, Fresh Water Service, Brine Service, Ice Water Circulation, Filter Service.
217 *Aurora Pump Div., N.Y. Air Brake

Pump, Vacuum.....The new series "H" Microvac pumps are compact, balanced & quiet. Models up to 500 c.f.m. displacement. Complete literature & application assistance.
200 *F. J. Stokes Corp.

Services & miscellaneous

Bench-Scale Equipment.....a complete integrated line of professionally designed equipment for pressures up to 5000 p.s.i. Detailed information in Bulletin 658.
118 *Autoclave Engineers, Inc.

Drying Laboratory .....helps solve drying problems in connection with products that may be fragile, heat sensitive, oxidizable, toxic, etc. Full information.
165 *Wyssmont Co., Inc.

Exchanger Cleaning.....Detailed literature on this cleaning process and other chemical plant maintenance operations is available on request.
218 *Oakite Products, Inc.

Fabrication.....A wide range of products & services directly to the chemical & petrochemical industries. Complete brochure "Heavy Steel Fabrication."
232 *Avondale Marine Ways, Inc.

Fire Protection.....Illustrated booklet on fire fighting products is offered. Also information on fire fighting systems & all purpose foam systems is available.
44 *Rockwood Sprinker Co.

Magic Markers.....Three types available with transparent inks, opaque inks, & heavy opaque inks. Tech. bulletins on specific marking, stamping, & stencilling problems.
L197 *Speedry Products, Inc.

Odor Control.....Brochure covers plant and product reodorization for the petroleum industry. Listed are sources of objectionable odors, guide to elimination.
240A Rhodia Inc.

Pressurized Systems.....are pressure-operated, self contained....need no outside power. Fast, clean carbon dioxide snuffs fire in seconds, then vanishes. Booklet.
213 *Walter Kidde & Co., Inc.

Service.....for Petro-Chemicals includes field & erection personnel, certified service shop, warehouse stocks, plus industry-designed equipment. Details offered.
189 *Allis-Chalmers

Slide Rule.....for polyethylene film & bag measurements has been developed. Permits rapid determination of width, length, total area, weight, etc. Information No. 1513.
207-208f *U. S. Industrial Chemicals Co.

* From advertisement, this issue

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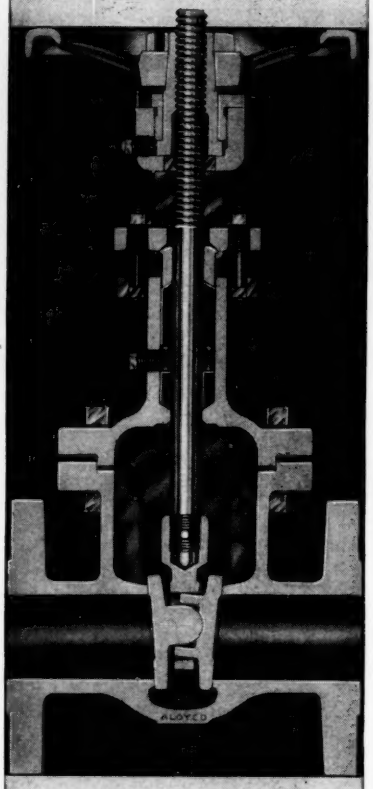

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100 CFM	150 PSI	6x7 Ing. ES-I
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238 CFM	100 PSI	9x9 Ing. ES Worth HB
311 CFM	1500 PSI	10½-7½-3½x13 IR-ES3
465 CFM	100 PSI	12x11-IR-ES-I-Worth HB
496 CFM	Vac.	14x7 CP-T (3)
502 CFM	125 PSI	12x13 Worth HB, IR-ES
528 CFM	100 PSI	14x12 Ing. ERI
686 CFM	100 PSI	14x13 Ing. ES
823 CFM	Vac.	18x7 Ing. ES-I
870 CFM	100 PSI	17-10½x12 Ing. XRE
1545 CFM	110 PSI	21/13x14 IR XRE
3135 CFM	Vac.	31x13 Ing. ES

60'-600' portable—gas or diesel

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SINGLE ITEMS OR ENTIRE PLANTS
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Centrifugal—Tolhurst 20" SS, Hyd. drive
Tolhurst 32" bronze, SUS
Tolhurst 40" bronze, SUS
Filters—Sparkler 33-26 Rubber lined
Sperry—36" plate & frame
Kettles—SS 20 gal to 200 gal. with and without agitators
Pressure Cooker—75 gal. Lee, jacketed, 90 PSI—internal 15 lbs. all SS pneu. operated cover.
Mills—Mikro 2TH, 1 Fitz Model D, Prater G5, Premier Colloid 3".
Mixers—Baker Perkins 17, 30 H.P.
Baker Perkins 17, DAM, 80 H.P.
W & P 17, 30 H.P.

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Stainless Steel - new and used.
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Autoclave: 50 gal. Struthers Wells, st. st.
Centrifugal: Tolhurst 20" st. steel (New)
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Dryers: Link-Belt Monotube of monel.
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Kettles: St. Steel, with and without ag. Dopp 150 gal. dbl. act. agitator.
Mills Micro Bantam, 2th and 24".
Fitz Comminuting model D, st. st.
Colloid, 3, 5, 20, 25 hp.
Ceq stain. steel, 10 hp.
Hammer: Williams, Jeffery, Prater, Ray.
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Baker-Perkins size 17, 30 hp.
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Percolator: Pfaudler 54 x 42" st. st. jack.
Pumps: Rotary, gear, centrif., vacuum.
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Stainless Steel Condenser 54 sq. ft.
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Cylindrical Spiral Mixer 3' x12' Jack.
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CENTRIFUGALS AND CENTRIFUGES
3—Bird 18" x 28", continuous, Stainless & Steel Bowls.
1—Bird 36" x 50", continuous, Steel Bowl.
10—Sharples #6 & #16 Super Centrifuges, Stainless & Steel Bowls.
1—DeLaval #600 Separator.
1—Sharples Nozzlejector, 15 HP.
1—12" Stainless Basket.
1—Tolhurst 26" Steel Basket.
1—Fletcher 30" Steel Basket.
1—Tolhurst 32" Steel Basket.
1—AT&M 36" Rubber Basket.
1—Hepworth 40" Steel Basket.
2—Tolhurst 40" Steel Baskets.
1—Tolhurst 40" Bronze Basket.
1—Bird 40" Rubber Covered Basket.
1—Fletcher 40" Stainless Basket.
1—Bird 40" Stainless Basket.
1—AT&M 48" Stainless Basket only.
2—International Model FS-3, Bronze Baskets.

CRYSTALLIZERS
3—Swenson Walker 30' continuous, Steel.

ATMOSPHERIC ROTARY DRYERS
1—30" x 12' Aluminum Shell.
1—Vulcan 4' x 30'.
1—Link Belt 6'4" x 24".
2—Vulcan 7' x 80'.
3—Louisville 8' x 50', Stainless Shells.

VACUUM DRYERS
1—Stokes 30" x 8' Rotary.
1—Devine 10 shelf, 40" x 43".
3—Buffalo 20 shelf, 60" x 80".
1—Devine 3 shelf, 14" x 14".
1—Baker Perkins 5'6" x 6' Rotary.

ATMOSPHERIC DRUM DRYERS OR FLAKERS
2—Devine 48" x 108", Single Drum.
2—Buflovak 42" x 120", Double Drum.
1—Buflovak 48" x 28", Bronze, Single Drum.
1—Buflovak 24" x 36", Single Drum.

DRYING OVENS AND FURNACES
1—American Sterilizer, 3' x 2' x 3', electric.
1—Precision Sterilizer, 18" x 18" x 18", electric.
1—Hudson Heat Treating Furnace size 4, gas.

DIALYZERS
2—Brosite Machine Co., Steel and Stainless Leaves.

EVAPORATORS
1—Harris 3' dia. x 8½' high, Stainless.
1—Condenser Service 5' dia. x 6' high, Stainless, 120 sq. ft.

FILTER PRESSES
2—Shriver 12" x 12", Cast Iron.
6—Shriver & Sperry 18" x 18", Cast Iron.
4—Sperry 24" x 24", Cast Iron.
2—Sperry & Shriver, 30" x 30", Cast Iron.
1—Shriver 36" x 36" Cast Iron.
3—Skeletons, 18" x 18", 24" x 24", 32" x 32", 36" x 36".
1—Sperry 24" x 24", Aluminum.

SWEETLAND FILTERS
2—#7 Sweetland Filters.
2—#10 Sweetland Filters.
3—#12 Sweetland Filters.

ROTARY FILTERS
1—Oliver 5'3" x 8', 130 sq. ft.
1—Conkey 3' dia., 27 sq. ft.
1—Oliver Precoat 5'3" x 3', Rubber covered.

PRESSURE FILTERS
1—Sparkler 33-S-28, 151 sq. ft. Stainless.
3—Niagara 36H-110-3, 1110 sq. ft., Stainless.

FILLING MACHINES
1—Stokes & Smith G-1.
1—National Model H Type M.
2—Rodgers Model 104.
1—Standard Knapp Case Packer.
1—Rodgers 9A Paste Filler.

INERT GAS GENERATOR
1—Kemp Size 3 MITHE, 3000 cfm.

CONDENSERS—HEAT EXCHANGERS
9—Struthers Wells, 20 sq. ft., Stainless.
2—Western, 28 sq. ft., Stainless.
2—Devine, 40 sq. ft., Copper tubes.
3—Devine, 60 sq. ft., Copper tubes.
4—Killebrew & Struthers Wells, 65 sq. ft., Stainless.
1—Whitlock, 90 sq. ft., Steel.
1—Devine, 90 sq. ft., Steel.
1—Devine, 115 sq. ft., Copper tubes.
1—Struthers Wells, 115 sq. ft., Stainless.
1—Alco, 157 sq. ft., Stainless.
5—Karbate, 187 sq. ft.
1—Western, 250 sq. ft., Stainless.
5—Struthers Wells, 275 sq. ft., Steel.
1—Struthers Wells, 315 sq. ft., Stainless.
1—Vogt, 352 sq. ft., Stainless.
6—Alco, 360 sq. ft., Steel.
1—General American, 370 sq. ft., Stainless.
1—S. & K., 400 sq. ft., Stainless.
1—Western, 430 sq. ft., Steel.
1—Struthers Wells, 500 sq. ft., Steel.
1—Struthers Wells, 536 sq. ft., Stainless.
1—Acme, 594 sq. ft., Copper tubes.
1—Nooter, 786 sq. ft., Stainless.
1—Downington, 850 sq. ft., Copper tubes.
1—Buflovak, 1080 sq. ft., Stainless
1—Vulcan, 1220 sq. ft., Stainless.
1—Croll-Reynolds Barometric type 52-B, neoprene lined, 4'4" x 14'.

HYDRAULIC PRESSES
1—H.P.M. Steeping Press, 88 tons.
1—H.P.M. Steeping Press, 63 tons.
1—Lab. Hyd. Press 8" x 8".

KETTLES—REACTORS
1—Pfaudler 2 gal. glass lined, jacketed.
1—Patterson Kelly 50 gal., Steel, jacketed.
2—Dopp 80 gal., Steel, jacketed.
2—Dopp 150 gal., Steel, jacketed, agitated.
1—Pfaudler 250 gal., Hastelloy C, jacketed.
1—Walter 500 gal., stainless, jacketed, agitated.
1—650 gal., steel, jacketed, 150 psi.
4—Buflovak 750 gal., Steel, jacketed, agitated.
2—Patterson 1000 gal., Steel, jacketed, agitated.
1—Blaw-Knox 1000 gal., Stainless, jacketed, agitated.
6—Struthers Wells 2000 gal., Stainless, jacketed, agitated.
1—Newman 3000# Steel, jacketed, agitated Crutcher.

LABELERS
5—World, National and Ermold Semi-Automatic, motor driven.

PEBBLE AND JAR MILLS
1—Abbe 3'9" x 3'6" silex lined Pebble Mill.
1—Abbe 4' x 5' silex lined Pebble Mill.
1—Abbe 5' x 6' silex lined Pebble Mill.
2—Abbe #1 Eureka Jar Mills, 9 gal.
1—Abbe double Jar Mill 2.6 gal. each.
1—Abbe 10 Jar Mill .8 pint each.

CRUSHERS—PULVERIZERS
1—Jeffrey 18" x 18" single roll Crusher, 10 HP.
1—Fitz Mill model D, Stainless, 7½ HP.
4—Jeffrey 8" x 15", 12" x 20", Hammer Mills.
1—Williams #1 Heavy Duty Hammer Mill, 30 HP.
1—Fairbanks Morse Hammer Mill, 15 HP.
1—Schutte type F Hammer Mill, 50 HP.
1—Williams Hammer Mill, 5 HP.
1—Raymond #00 Screen Mill, 10 HP.
5—Day, Kent and Mead Cage & Disc Mills.
2—Day 18" dia. Pressure type Ointment Mills.
2—Stokes 8" dia. Drug Mills, ½ HP.

MIXERS
1—55 gal. Drum Rolling, ¾ HP.
2—Day #9 "Cincinnatus" double arm, 250 gal.
2—Day #6 "Cincinnatus" double arm, 100 gal.
1—Baker Perkins #16 TRM double arm, vacuum, 150 gal., 60 HP.
1—Day #1 "Cincinnatus" double arm, 10 gal.
1—Baker Perkins #14 double arm, 50 gal.
16—Day, Horizontal, Powder; 200, 400, 600, 1000 and 1500#.
1—10 cu. ft. "V" type Stainless, 2 HP.
1—Sprout Waldron 7000#, Horizontal, Powder, jacketed.
1—Robinson 10,000# Horizontal, powder, jacketed.
2—Abbe Aluminum, Horizontal, 400 and 1000#.
3—McClellon 1 cu. ft., Stainless, Conical.
1—Stokes 200#, granulating.
1—Ross 50 gal., Mammoth Change Can.
1—Eppenbach 1 HP Stainless Homo Mixer.

PUMPS
12—Nash Hytor Vacuum; #7, #2 #TS7, and #1251.
2—Stokes Microvac 10 and 115 cfm.
10—Moyno Rubber, Steel and Stainless, 1" to 4".
12—Proportioning; Ray, Lapp, Hills-McKenna, 75 gph to 705 gph, Stainless.
17—Durco Centrifugal; 1" to 4"; Durion, Durimet, Chlorimet.
11—LaBour Centrifugal; 1" to 3", Stainless.
7—Taber Centrifugal; 1" to 3", Stainless.
3—Lawrence Vertical Centrifugal; 2½" x 1½", Stainless.
5—Worthite Centrifugal; 1" to 3", Stainless.
5—Oliver Centrifugal; 2" to 5", Olivite.
4—Quimby Centrifugal; 1" to 2", Rubber and Lead.
5—Wilfley Centrifugal; 4", Haveg.
23—Worthington, I. R., Deming, Dayton-Dowd; Centrifugal and Rotary; Iron and Bronze; 1" to 8".

VIBRATING SIFTERS
3—Robinson Triple Deck 30" x 104".
2—Rotex Double Deck 40" x 84".
3—Rotex Single Deck 60" x 84".
3—Robinson Single Deck 40" x 84", Stainless.
4—Sprout Waldron Single Deck 40" x 84", Stainless.
1—Link Belt Single Deck, 3' x 8'.
1—Allis-Chalmers Multiple Deck, Low Head.

TABLET PRESSES
2—Stokes DDS2, DD2, Rotary, 7½ HP.
1—Kux model 15-25, Rotary, 5 HP.
1—Colton model 10-35, Rotary, 2 HP.
5—Stokes Single Punch, models R, T, F.

TANKS
1—Haveg 1500 gal., Horizontal, 15 psi.
1—1000 gal., Stainless, Vertical, Closed.
1—500 gal., Stainless, Vertical, Closed.
1—200 gal. Stainless, Horizontal.
1—Pfaudler 60 gal., Glass lined, vacuum.
1—2000 gal., Steel, Vertical, Mixing.
1—4000 gal., Steel, Horizontal, 150 psi.
1—6000 gal., Steel, Horizontal, 75 psi.

BRILL EQUIPMENT COMPANY

2401 THIRD AVENUE, NEW YORK 51, N. Y. Telephone: CYpress 2-5703

JUST PURCHASED

1—Link-Belt #604-18 roto-louvre dryer, 6'4" dia. x 18' long, w/cyclone, fans, etc.
1—Link-Belt #310-20 roto-louvre dryer, 3'10" dia. x 20' long.

STOCK ITEMS

STAINLESS REACTORS—KETTLES

3—3500 gal. T316 SS, jkt. & agit.
2—2250 gal. T316 SS, jkt. & agit.
1—1400 gal. T316 SS, jkt, 20 HP XP agit.
1—1300 gal. T304 SS, jkt., 5 HP XP agit.
3—750 gal. T304 SS, jkt. & agit.
1—500 gal. T304 SS, jkt. & agit.
6—465 gal., T304L SS, jkt. & agit.
1—350 gal., T304 SS, jkt. & agit.
2—125 gal., T316 SS, jkt.

ROTARY KILNS—DRYERS

1—11' x 155' Traylor, ⅞" shell Kiln.
1—9' x 100' Vulcan, ⅝" shell Kiln.
1—8' x 125' Kiln, ⅝" shell.
1—8' x 115' ⅝" shell, 2-tire Kiln.
2—7'6" x 100' ½" shell Kilns.
1—7'6" x 60' Kiln, ½" shell.
4—Hardinge 8'8" x 70' dryers, ⅝" shell.
1—7'6" x 60' dryer, ½" welded shell.
1—Allis-Chalmers 7' x 50' dryer.
1—6' x 50' Louisville dryer.
8—Steel dryers: 5'6" x 50', 4'9" x 32', 4'6" x 40', 4'6" x 32', 4' x 30', 3' x 15'.
2—Stainless dryers: 4'6" x 12', 3' x 10'.

TANKS

1—8000 gal. T304 SS, vert.
12—4500 gal. nickel-clad, vert. 125#.
1—3000 gal. alum., vert., open.
1—10,500 gal., T 304 SS, horiz., UNUSED, dished heads.
2—5700 gal., T304 SS, horiz., UNUSED.
4—Vacuum tanks w/coils, T304 SS: 3700, 3000, 2350, 1750 gal.
1—3400 gal., T304 SS, horiz.
1—2000 gal., T316 SS, hopper.
8—1750 gal., T304 SS, hoppers.
1—1400 gal., T316 SS, ASME, 175#.

JUST PURCHASED

3—Baker Perkins #15, 100 gal. jkt. sigma mixers
1—Sharples #PN-14 Super-D-Canter, T316 SS
5—A.T.&M. 40" susp. cent. T304 SS
1—#4TH mikro, stirrup hammers

LIQUIDATING

CHEMICAL PLANT—ORANGE, TEXAS

SPECIAL ITEMS

2—1800 cu. ft. Read weigh hoppers, T304 SS, 11'10" x 10'5" x 10'2", hopper bottom.
3—Worthington 160 ton steam-jet vacuum refrigeration units.
3—18,000 gal. alum. cone-bottom tanks, 12' x 31' OAH.
2—Buffalo T316 SS blowers, 2330 cfm, 60 HP.
2—American T316 SS blowers, 5600 cfm, 50 HP.

CENT.—FILTERS—CRYSTALLIZERS

2—Sharples C-20 Super-D-Hydrators, T316 SS.
1—Alco 110 sq. ft. pressure leaf filter, T316 SS.
11—Struthers-Wells vacuum crystallizers, 1200, 560 gal., T316 SS, cone bottoms.
1—Elmco T304 SS rotary vac. filter, 18" dia. x 24" face.

EXCHANGERS—CONDENSERS—COOLERS

12—800 sq. ft. T316 SS heat exchangers, removable bundle.
75—T316 tubular heat exchangers & condensers, 2000, 1450, 880, 800, 750, 600, 530, 427, 425, 400, 300, 264, 250, 235, 200, 185, 165, 150, 125, 100, 64, 50, 47, 30 sq. ft.
25—Copper & Cupro-Nickel heat exchangers & condensers, up to 1070 sq. ft.

TYPE 316 SS KETTLES

3—3,500 gal. Struthers-Wells vert., 7' dia. x 12' high, jacketed, int. coils, 40/20 HP agit.
1—2,830 gal. horiz. still kettle, 6' dia. x 12' long, 100 sq. ft. int. coil.
2—2,250 gal. vert., 7' dia. x 6'3" high shell jacket, 3 HP turbine agit.

TYPE 316 STAINLESS STEEL TANKS

1—17,650 gal. horiz., 9' dia. x 36' long, ¼" shell, ⅜" dished heads.
1—8,500 gal. vert., 8' x 21'6", dished heads, int. coil.
1—2,830 gal. horiz., 6' x 12', 5/16 shell & dished heads, VACUUM.
3—2,750 gal. vert., 7' x 8', dished heads, int. coils.
9—2,300 gal. vert., 7' x 8', int. coils, (some w/agit.).
5—2,250 gal. vert., 7' x 6'3", dished heads, (some w/agit., some w/jacket).
2—1,900 gal. vert., 6' x 8', ⅜" shell & dished heads, VACUUM.
4—1,200 gal. vert., 5' x 7', dished top, cone bot., VACUUM.
6—685 gal. vert., 3' x 13', internal coils.
1—575 gal. vert., 4' x 6', dished heads, int. coil.
7—560 gal. vert., 3'6" x 7', dish top, cone bot., VACUUM.
50 Tanks & pots, 30 to 500 gal., T316 SS.

COLUMNS—STAINLESS STEEL

1—110" dia. Vulcan, 10 trays—bubble caps, T316 SS.
2—96" dia. Vulcan, 30 trays—bubble caps, T316 SS.
1—96" dia. Vulcan, 10 trays—bubble caps, T316 SS.
2—60" dia. Vulcan, 10 trays—bubble caps, T316 SS.
1—48" dia. Vulcan, 25 trays—bubble caps, T304 ELC SS, 100 PSI.
3—24" dia. Vulcan, 12 trays—bubble caps, T316 SS—VACUUM.
6—T316 SS Packed Columns: 42", 36", 30", 24", 20" dia.
5—Steel Packed Columns: 60", 48", 36", 30", 20".

COLUMNS—COPPER

1—72" dia. Vulcan, 40 trays—bubble caps—VACUUM.
3—48" dia. Vulcan, 25 & 22 trays—bubble caps—VACUUM.
1—24" dia. Vulcan, 20 trays—bubble caps.

MISCELLANEOUS EQUIP.

2000—T316 SS flanged valves, globe or gate, ½", 1", 1½" up to 12"
10,000'—T316 SS pipe, schedule 40, 10, 5, sizes ½", 1", 1½", 2" up to 12"
50—T316 SS pumps, sizes from 6" x 5" to 1" x 1"
1—Otis elec. freight elevator, 5000# capacity @ 75 FPM
2—Stainless steel reboilers
2—Stainless steel bucket elevators, 60' & 40' high
1—2,100 gal. vert. alum. tank, coils
10—T316 SS separators, 22" x 8' deep
1—2,000 gal. copper tank
3—18,000 gal. steel tanks

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GELB

CHEMICAL PROCESS EQUIPMENT

1—Niagara SS filter, Model 36H-110-3
4—Badger type 316 SS heat exchangers, 170, 500 and 600 sq. ft.
4—Alco type 316 SS jacketed reactors, 3000 gal.
2—Louisville SS rotary dryers, 8' x 50'

AUTOCLAVES, KETTLES AND REACTORS

1—Allied Steel Products type 316 SS jacketed reactor, 750 gal.
2—Type 316 SS 600 gal. jacketed kettles
1—Pfaudler type 316 SS 150 gal. jacketed reactor, complete with agitator and drive
1—Steel & Alloy Tank Co. 125 gal. type 347 SS jacketed autoclave, 250 psi jacket and 250 psi internal
1—Steel & Alloy Tank Co. 350 gal. type 347 SS pressure tank, 250 psi jacket
1—Steel & Alloy Tank Co. 100 gal. type 347 SS pressure tank, 250 psi jacket
1—Blaw-Knox 400 gal. steel jacketed autoclave, 570# internal pressure, 85# jacket
1—Blaw-Knox 45 gal. jacketed autoclave, 1500# pressure
1—Pfaudler 500 gal. glass lined reactor, complete with anchor type agitator and drive
1—Edgemoor Iron Works type 316 SS jacketed reactor, 750 gal.
2—Struthers Wells 500 gal. nickel jacketed reactors
1—Patterson-Kelley 6000 gal. steel jacketed reactor, 40# jacket, complete with agitator and drive
1—Patterson 2000 gal. steel jacketed reactor
28—30,000 gal. steel vertical storage tanks

DRYERS

1—Link Belt steel roto louver dryer, Model 1003-30
3—Link Belt steel roto louver dryers, Model 207-10, 310-16, 604-20
1—Buflovak double drum dryer 42" x 120"
1—Stokes Model 59DS steel rotary vacuum dryer, 5' x 30'
1—Stokes double drum dryer, 5' x 12'
1—Louisville rotary steam tube dryer, 8' x 45'
1—Louisville SS rotary kiln, 30" x 28', complete
1—Louisville Rotary dryer, 38" x 40', Type L.
1—Ruggles Coles 4' x 30' rotary kiln
1—Traylor 4' x 40' rotary dryer
1—Swenson 10' dia. spray dryer
2—Rotary dryers, 6' x 36'

FILTERS

3—Dorrco rubber covered filters, 6' x 2'
1—Sweetland #3 SS filter
1—Feinc SS rotary vacuum string filter, 3' x 3' (NEW)
1—Niagara SS filter, Model 510-28
1—Oliver horizontal filter, 3'
10—Shriver plate and frame filter presses, 12" to 42"
1—Shriver rubbed lined filter press, 36" x 36"
12—Sweetland #12 filters with 72 SS leaves

CENTRIFUGES

1—Tolhurst SS 20" suspended type centrifuge with perforated basket, complete with motor and plow
1—AT&M 26" suspended type centrifuge with SS perforated basket, complete with motor and plow
1—AT&M 48" SS suspended type centrifuge complete with plow, motor and imperforated basket

THE GELB GIRL—SEPTEMBER 1959

1—Sharples type 316 SS Super-D-Hydrator, Model C-20
1—Sharples type 316 SS Super-D-Canter
1—Bird type 316 SS centrifuge 32" x 50"
4—Tolhurst 30" center slung rubber covered centrifuges with perforated baskets and motors

MIXERS

3—Robinson type 316 SS sigma type jacketed heavy duty mixers, 400 gal.
5—Baker Perkins double arm sigma blade mixers, 100 gal.
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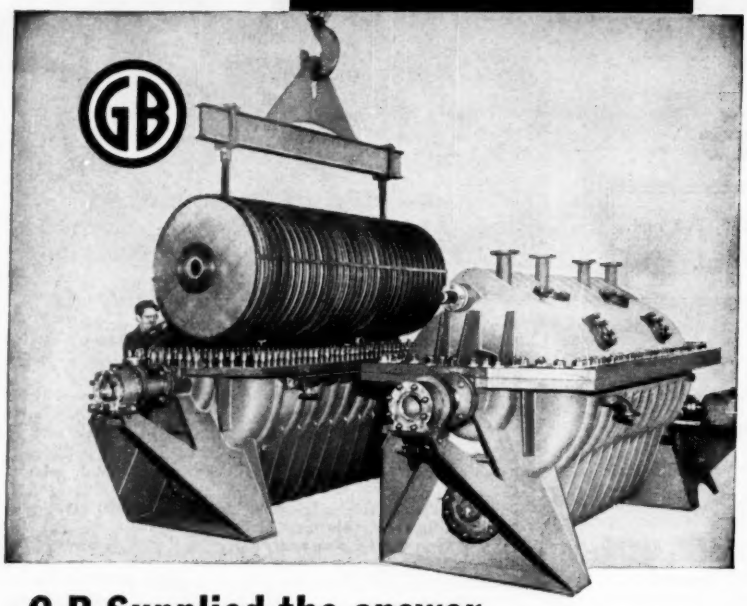

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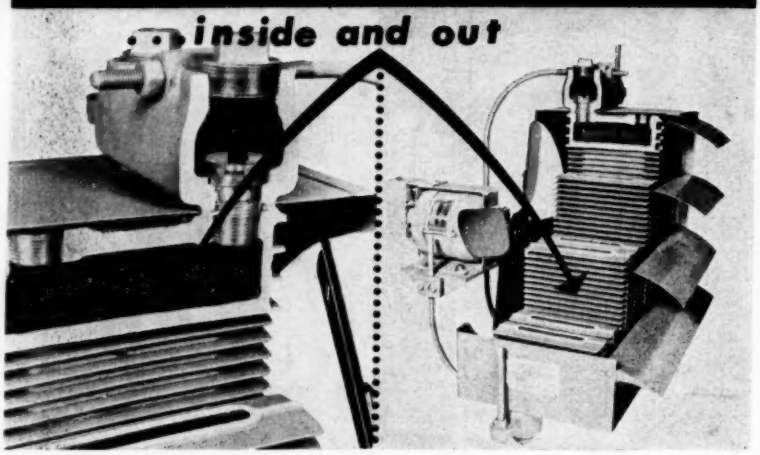

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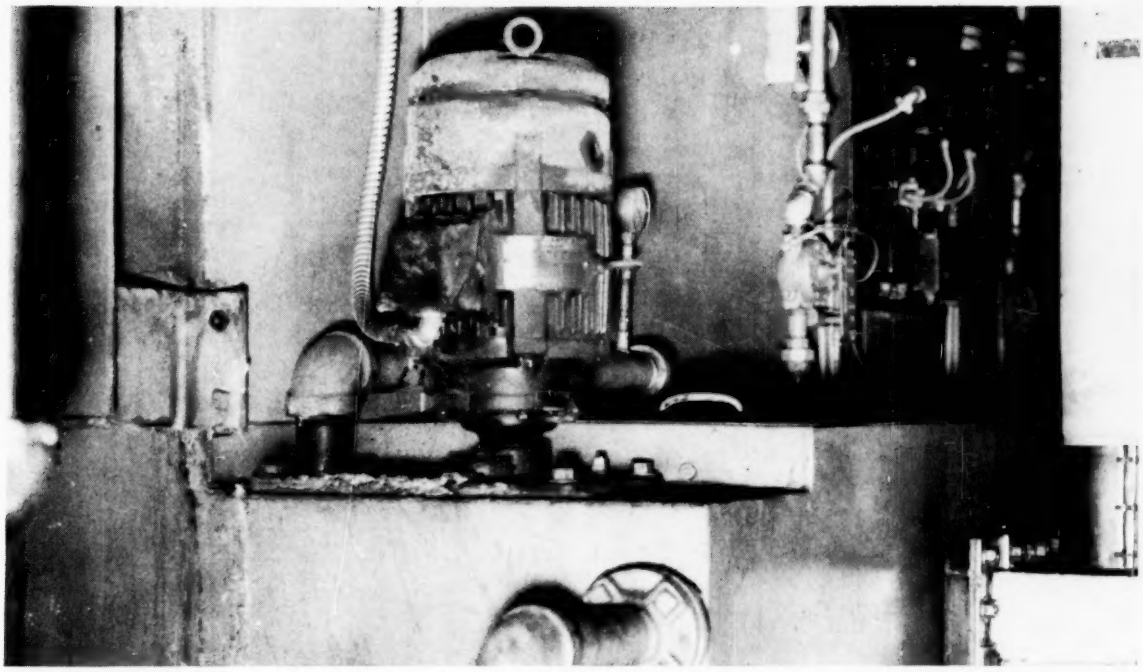

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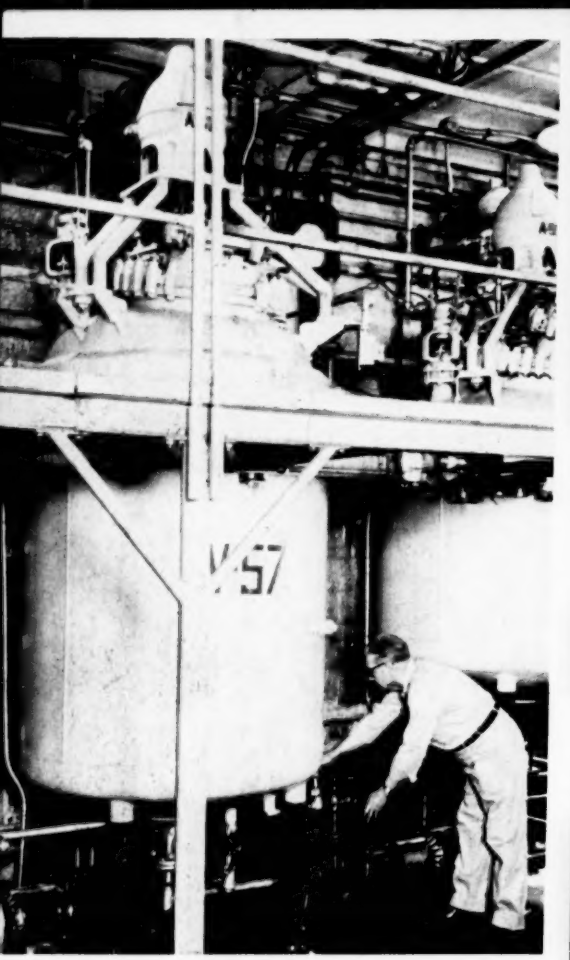

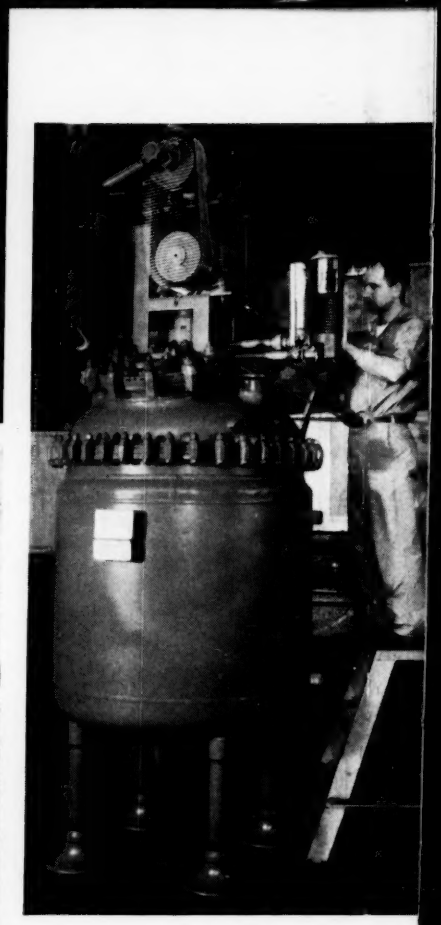

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